

SPECIAL REPORT

LOWER SNAKE RIVER FISH AND WILDLIFE COMPENSATION PLAN



***Lower Snake River,
Washington and Idaho***

U. S. ARMY ENGINEER DISTRICT, WALLA WALLA, WASHINGTON

JUNE 1975



REPLY TO
ATTENTION OF

DEPARTMENT OF THE ARMY
OFFICE OF THE CHIEF OF ENGINEERS
WASHINGTON, D.C. 20314

LSRCP Cond. Officer

Kind Copy

25.2

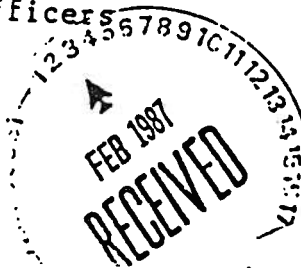
DAEN-CWP-A

March 6, 1985

SUBJECT: Lower Snake River Fish and Wildlife Compensation Plan,
Washington and Idaho *Special report*

THE SECRETARY OF THE ARMY

1. I submit for transmission to Congress my report, accompanied by the special reports of the Division and District Engineers, on implementation of the plan authorized by the Water Resources Development Act of 1976 to compensate for loss and damage to fish and wildlife resources resulting from construction of the Ice Harbor, Lower Monumental, Little Goose and Lower Granite dams on the Snake River in Washington and Idaho. This report fulfills the commitment of the Chief of Engineers to advise the Congress not later than five years after first receipt of funds for this project on the extent to which it has been practicable to carry out the acquisition of lands and interest in lands under the procedures authorized, and if necessary to recommend such further measures as may be desirable to assure timely accomplishment of the authorized compensation plan. Funds for implementation of the compensation plan were first appropriated in Fiscal Year 1978, and allocations through Fiscal Year 1985 total \$106,361,000.
2. The authorized plan includes extensive developments for propagation of both anadromous and resident fish, provision of fisherman access to the Snake River and its tributaries, the acquisition of rights in real property for hatchery construction and for propagation and hunting of wildlife and for the stocking of game birds on these lands and project lands for a period of twenty years. Initial costs of \$168 million are all Federal, but reimbursement through sale of hydroelectric power from the Snake River dams will reduce the ultimate Federal cost to about \$4.1 million based on the latest approved estimates.
3. Accomplishments to date are described below:
 - a. Most of the lands authorized to be obtained under usual real estate acquisition procedures for construction of fish hatcheries have been obtained. The reporting officers



DAEN-CWP-A

SUBJECT: Lower Snake River Fish and Wildlife Compensation Plan,
Washington and Idaho

find that implementation of the authorized measures for compensation of fishery losses is proceeding satisfactorily and is currently about 58 percent complete.

b. Fewer than 20 of the 750 acres authorized to be acquired for fisherman access have been obtained, and no lands or interest in lands have been acquired for the wildlife compensation features of the plan under the authorized willing seller-willing buyer concept. The complexity of uses and estates, questions of accessibility and potential vandalism and possible interference by the public with normal farming and ranching operations have been of great concern to area landowners. The net result is that no real estate interests have been obtained in spite of three years of negotiations by the state agencies and the Corps of Engineers with more than 250 landowners controlling over 80,000 acres.

4. The reporting officers conclude that this lack of progress can be overcome by retaining the willing seller-willing buyer concept for acquisition if the requirement to obtain less-than-fee is removed and entire ownerships could be acquired from willing sellers in fee or easement. The reporting officers further conclude that:

a. Changed circumstances warrant modification of the authorized game bird stocking feature of the authorized plan.

b. Title to separable wildlife compensation lands should be vested in the states, except for lands contiguous to the Corps projects, with the costs of acquisition and initial development funded by the Corps and the costs of wildlife management funded by the agency holding title.

c. The land acquisition-effort should be extended for an additional five years after the date of authorization of proposed modifications and funding.

d. The U. S. Fish and Wildlife Service should be designated to fund the operation and maintenance of all fish rearing facilities.

5. Therefore, the reporting officers recommend modification of the current authorization to provide for:

a. Acquisition of lands from willing sellers, in fee as well as easement (including acquisition of entire farm units),

DAEN-CWP-A

SUBJECT: Lower Snake River Fish and Wildlife Compensation Plan,
Washington and Idaho

not to exceed the previously authorized aggregate total of
24,150 acres.

b. Title to compensation lands be acquired by and vested in appropriate state agencies, except for lands contiguous to the four Corps of Engineers projects, with all costs of acquisition and initial development funded by the Corps of Engineers and all costs of operation, maintenance, and replacement funded by the agency holding interest in the lands.

c. Extension of the period for completion of acquisition for an additional five years following authorization and funding of these recommended modifications.

d. Modification of the game bird stocking feature of the authorized plan to provide for funding of a contractual arrangement with landowners to plant or leave nesting cover which will increase natural production, and to supplement this program with artificially reared birds obtained from public or private sources, through the year 2002.

e. Transfer of jurisdiction over all compensation plan fish hatcheries, appurtenant facilities and lands to the U. S. Fish and Wildlife Service for operation, maintenance, and replacement upon completion of construction by the Corps of Engineers.

6. I note that in making their recommendations the reporting officers concluded that changed circumstances warrant modification of the authorized game bird stocking feature of the authorized plan. However, I find that no modification of the existing authorization is required since no additional lands will be acquired and the implementation period would not be extended beyond the period authorized, and the cost will not exceed current estimates for this feature. This feature of the authorized plan can be accomplished under my discretionary authority.

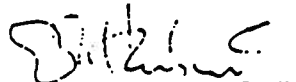
7. Subject to the foregoing, I concur in the views and recommendations of the reporting officers, with such further modification as in the discretion of the Chief of Engineers may be advisable.

8. The recommendations contained herein reflect the information available at this time and current Departmental policies governing formulation of individual projects. They do not

DAEN-CWP-A

SUBJECT: Lower Snake River Fish and Wildlife Compensation Plan,
Washington and Idaho

reflect program formulation of a national Civil Works construction program nor the perspective of higher review levels within the Executive Branch. Consequently, the recommendations may be modified before they are transmitted to the Congress as proposals for authorization and/or implementation funding.



E. R. HEIBERG III
Lieutenant General, USA
Chief of Engineers

TABLE OF CONTENTS

<u>Title</u>	<u>Page</u>
AUTHORITY	1
BACKGROUND	3
Ice Harbor Dam	4
Lower Monumental Dam	5
Little Goose Dam	6
Lower Granite Dam	7
PROJECT IMPACTS ON ANADROMOUS AND RESIDENT FISH	10
PRE-PROJECT CONDITIONS	10
Size of Anadromous Fish Runs	12
Anadromous Fish Spawning Grounds	18
Steelhead Sport Fishery	18
Resident Sport Fishery	20
PRESENT PROJECT CONDITIONS	20
Anadromous Fish Run Losses	20
Anadromous Sport Fishery Losses	21
Resident Sport Fishery Losses	23
FISH AND WILDLIFE AGENCIES' RECOMMENDED COMPENSATION MEASURES FOR FISHERIES LOSSES	23
Anadromous Fish Runs	23
Anadromous Sport Fishery	25
Lower Snake River Resident Sport Fishery	25
DISCUSSION	25
Anadromous Fish Runs	25
Anadromous Sport Fishery	40
Resident Sport Fishery	41

TABLE OF CONTENTS (Continued)

<u>Title</u>	<u>Page</u>
ALTERNATIVES TO THE PROPOSED ACTION	41
PLAN OF DEVELOPMENT	43
General	43
Anadromous Fish Runs	44
Fall Chinook	44
Spring and Summer Chinook	45
Steelhead Trout	47
Anadromous Sport Fishery	47
Resident Sport Fishery	49
Allocation of Costs	52
PROJECT IMPACTS ON WILDLIFE	55
PRE-PROJECT CONDITIONS	55
Big Game	55
Upland Game	58
Fur Animals	58
Migratory Game Birds	59
Nongame Wildlife	59
Appreciative Use	59
PRESENT PROJECT CONDITIONS	60
Big Game	61
Upland Game	61
Fur Animals	62
Migratory Game Birds	62
FISH AND WILDLIFE AGENCIES' RECOMMENDED COMPENSATION MEASURES FOR WILDLIFE LOSSES	62
DISCUSSION	66
ALTERNATIVES TO THE PROPOSED ACTION	72
PLAN OF DEVELOPMENT	73
General	73
Development of Project Lands	75
Development of Off-Project Lands	76
Allocation of Costs	83
STATEMENT OF FINDINGS	88
CONCLUSION	91
RECOMMENDATIONS	95

SYLLABUS

The purpose of this special report is to evaluate impacts on fish and wildlife resources caused by construction of the four Lower Snake River dams, Ice Harbor, Lower Monumental, Little Goose, and Lower Granite, and to recommend measures for compensating project-incurred losses to fish and wildlife. The report is submitted in compliance with the Fish and Wildlife Coordination Act, PL 85-264, 85th Congress, 12 August 1958, which requires the head of a construction agency responsible for losses to fish and wildlife through construction of a project to compensate for those losses to the fullest extent possible.

The four lower Snake River dams, constructed by the Corps of Engineers, impact upon the natural upstream and downstream migration of anadromous fish, inundate certain spawning grounds, flood riparian habitat supporting a variety of wildlife species and convert some 140 miles of stream-type habitat and fisheries to those associated with reservoirs. Fish and wildlife species affected include salmon, steelhead, sturgeon, deer, waterfowl, pheasant, quail, and chukar partridge. Even though fish passage facilities have already been incorporated in the four dams, studies indicate that additional measures are needed to fully compensate for adverse fish and wildlife impacts and displacements attributable to the projects. The District Engineer recommends a system of fish propagation facilities for salmon, steelhead, and resident species; game bird stocking; wildlife habitat development and acquisition of appropriate estates in lands for fish hatcheries, habitat development and fisherman and hunter access. Based on current prices, the estimated cost to provide the additional compensation measures is about \$46,000,000 and the additional operation and maintenance costs are estimated to be nearly \$3,000,000 annually. Annual benefits are evaluated at \$11,900,000; the resulting benefit-to-cost ratio is 2.0 to 1.



DEPARTMENT OF THE ARMY
WALLA WALLA DISTRICT, CORPS OF ENGINEERS

BLDG. 602, CITY-COUNTY AIRPORT
WALLA WALLA, WASHINGTON 99362

NPWEN-PL

30 May 1975

SUBJECT: Special Report - Lower Snake River Fish and Wildlife Compensation Plan, Lower Snake River, Washington and Idaho

Division Engineer, North Pacific

AUTHORITY

This is a special report of the Walla Walla District, U.S. Army, Corps of Engineers, on the impact of the Lower Snake River Project on fish and wildlife resources of the Project area. The Project was authorized by Public Law 14, 79th Congress, 1st Session, approved 2 March 1945, and consists of Ice Harbor, Lower Monumental, Little Goose, and Lower Granite Locks and Dams. The Project is located in Washington and Idaho as shown on Figure 1. The applicable portion of the Act reads as follows:

"... Snake River, Oregon, Washington, and Idaho: The construction of such dams as are necessary, and open channel improvement for purposes of providing slack-water navigation and irrigation in accordance with the plan submitted in House Document 704, 75th Congress, with such modifications as do not change the requirement to provide slack-water navigation as the Secretary of War may find advisable after consultation with the Secretary of the Interior and such other agencies as may be concerned: Provided, that surplus electric energy generated at the dams authorized in this item shall be delivered to the Secretary of the Interior for disposition in accordance with existing laws relating to the disposition of power at Bonneville Dam; provided further, that nothing in this paragraph shall be construed as conferring the power of condemnation of transmission lines; ..."

Neither the Act nor the general plans presented in House Document 704, 75th Congress, made any mention of fish and wildlife measures needed to

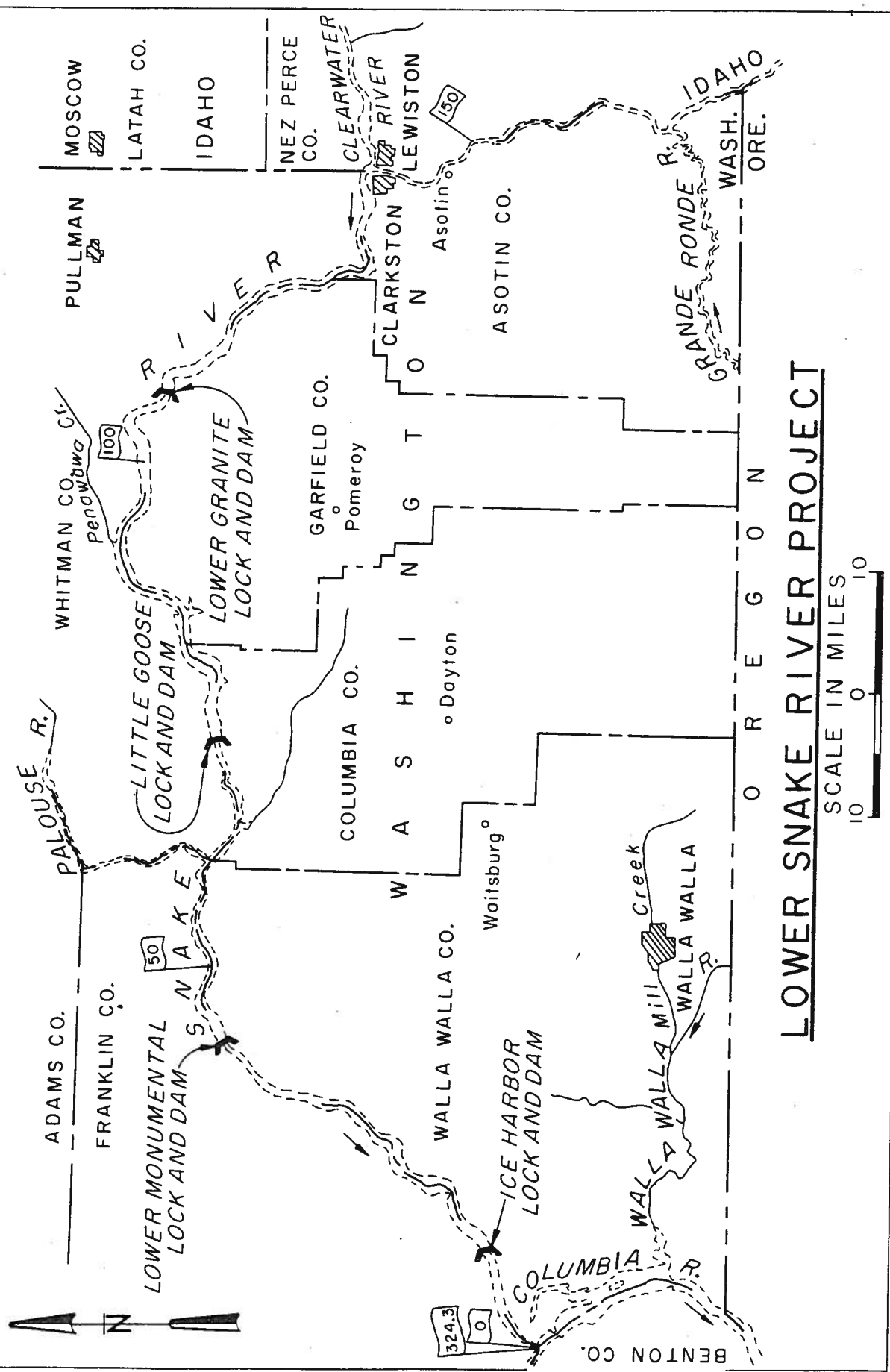


FIGURE 1

prevent or offset losses or damage to these important resources; therefore, fulfillment of the requirements of the Fish and Wildlife Coordination Act, PL 85-624, 85th Congress, enacted 12 August 1958, becomes the basic reason for submission of the compensation plan presented in this report. Sections 2(c) and 2(g) of the Fish and Wildlife Coordination Act provide necessary directive to the Corps of Engineers for funding and constructing justifiable compensation measures at the Lower Snake River Project, and Section 3(c), which requires authorization by Congress for acquisition of fish and wildlife lands, provides authority to the Corps for recommending such acquisition. This report recommends means to compensate for project-incurred losses to fish and wildlife based on a 100-year project life for each separable component.

BACKGROUND

The development of this report was initiated by a letter dated 11 April 1966 from the Walla Walla District Engineer to the Regional Director, Bureau of Sport Fisheries and Wildlife, requesting a report covering the impact of the four lower Snake River dams on the fish and wildlife resources of the area as a unit, rather than on a dam-by-dam basis. During the planning phases of the first three dams, Ice Harbor, Lower Monumental, and Little Goose, individual impact reports were received from the U.S. Fish and Wildlife Service. These reports were: (1) "A Detailed Report on the Fish and Wildlife Resources, Ice Harbor Lock and Dam Project, Snake River, Washington, May 1, 1959;" (2) "A Detailed Report on Fish and Wildlife Resources Affected by Lower Monumental Lock and Dam Project, Snake River, Washington, September 1960;" and (3) "A Detailed Report on Fish and Wildlife Resources Affected by Little Goose Lock and Dam Project, Snake River, Washington, May 7, 1963."

The initial recommendations in these reports for offsetting Project-incurred fish and wildlife losses were based on very limited engineering and biological information. Recommended fishery measures included fish passage at dams and artificial propagation facilities for salmon and steelhead trout. Recommended wildlife measures were leasing of small land and water areas scattered along the reservoirs to the Washington State Department of Game and provision of Project funds to the Department for

their management. These recommendations were not necessarily concurred with by all the wildlife agencies. Specifically, the recommendations and actions concerning them were as follows:

ICE HARBOR DAM

Recommendation. A designated area at river mile 25 be made available as a wildlife management area; fish protective facilities for upstream and downstream migrants be included in the project design.

Initial Action. The river mile 25 area was made available to the Washington State Department of Game on long-term license at no cost. To date no development or management work has been accomplished on this 260-acre unit of land because a comprehensive development plan and funding requirements satisfactory to the involved parties were never formulated. Upstream fish passage facilities were included in the project design at a total cost of \$12,591,000.

Subsequent Action. In 1969 the ice and trash sluiceway at the project was modified to provide a means of bypassing a portion of the downstream migrants which entered the turbine intakes around the power units. Slotted bulkheads were installed in the intakes to the three skeleton units of the powerhouse by spring 1972 to reduce the amount of water passed over the spillway during spring freshet seasons and resultant nitrogen supersaturation levels caused by high spillway flows. Construction of three additional power units was initiated in July 1973 to provide full power production capability. This precluded further use of the slotted bulkheads at this project after the spring high-flow season of 1973 except for possible future use in an operating unit. The three additional power units are scheduled to be completed by July 1975. Spillway deflector installation, which will prevent spillway discharges from plunging into the stilling basin thereby eliminating or greatly reducing nitrogen supersaturation of the water, is scheduled for completion in 1977.

LOWER MONUMENTAL DAM

Recommendation. Permanent and temporary fish passage facilities provided in project design; five specific areas on the reservoir, including project lands and acquired lands be made available to the Washington State Department of Game for wildlife management areas.

Initial Action. Both adult and downstream migrant fish passage facilities were included in project design at a cost of \$9,483,000. Project lands were made available for wildlife management in the requested units one and two comprising 700 acres. Off-project lands were not acquired at that time. The District determined that a recommendation for purchase of additional lands should be included in the comprehensive compensation report being prepared on the Lower Snake River Project. Unit three of project lands, comprising 640 acres, was made available on an interim-use basis and parts of units four and five, totaling about 300 acres, were designated fish and wildlife lands in conjunction with recreation and industrial use. To date no development or management work has been accomplished on these lands because a comprehensive development plan and funding requirements satisfactory to the involved parties were never formulated.

Subsequent Action. A prototype spillway deflector was installed in 1971 to test the effectiveness of this type of structure in preventing spillway discharges from plunging and causing a supersaturation of gasses. Preliminary evaluation indicated that nitrogen supersaturation was less in water which had passed over this deflector than over a conventional spillway bay, and that juvenile fish mortalities were negligible. On this basis five more deflectors were installed in 1974, leaving the end spillway bays unaltered. Tests conducted in spring 1974 by National Marine Fisheries Service indicated that the deflectors actually reduced the nitrogen content of highly saturated water passing over them, and that juvenile fish mortality was less when passing over the deflectors than over a conventional spillway. Slotted bulkheads were installed in

the intakes to the three skeleton units of the powerhouse by spring 1972 to reduce the amount of water passed over the spillway during spring freshet seasons and resultant nitrogen supersaturation levels caused by high spillway flows. Excessive mortality to juvenile salmonids passing through these bulkheads precluded their later use during the downstream migration period. A pilot program was begun in 1970, in cooperation with the Washington Game Department and Washington State University, to develop artificial Canada goose nesting sites. Three additional power generating units are scheduled to be installed between 1976 and 1978.

LITTLE GOOSE DAM

Recommendation. Permanent and temporary fish passage facilities be provided in project design; project funds be provided to conduct a study on nongame fish control; artificial propagation facilities be provided for 1,500 adult fall Chinook salmon to compensate for loss of spawning areas; artificial propagation facilities be provided to produce 400,000 juvenile steelhead annually to compensate for lost spawning areas; five specific areas on the reservoir, including project lands and acquired lands, be made available to the Washington State Department of Game for wildlife management areas.

Initial Action. Both adult and downstream migrant fish passage facilities were included in project design at a cost of \$5,900,000. On-going studies were then being conducted on nongame fish control under the Columbia River Fisheries Development Program; consequently, no project funds were made available for that purpose. It was recommended by the Corps of Engineers that the fall Chinook propagation facilities should also be accomplished through that program. Of the five wildlife management areas requested, unit two, totaling 238 acres, was designated for wildlife management in entirety. Unit one, comprising 172 acres, was on lands unavailable for wildlife because of other project needs, and portions of units three, four, and five, totaling about 325 acres, were designated wildlife management areas in conjunction with recreation and industrial uses. To date no development or management of these areas for wildlife use has occurred because a comprehensive development plan and funding requirements satisfactory to the involved parties were never formulated.

Subsequent Action. Traveling screens for diverting downstream migrant fish from the power units into the bypass system were installed in April 1973. Slotted bulkheads were installed in the intakes to the three skeleton units of the powerhouse by spring 1972. Excessive mortality to juvenile salmonids passing through these bulkheads precluded their later use during the downstream migration period. A six-year study of the efficiency of screening juvenile fish into the bypass system in the turbine intakes and of the feasibility of trapping downstream migrant salmonids and transporting them below Bonneville Dam for release was begun in 1971 by the National Marine Fisheries Service, funded by the Corps of Engineers. Preliminary results indicate that the transported juveniles have a higher survival to returning adults than those which migrate naturally to the ocean. The three additional generating units are scheduled for completion in 1978 and spillway deflector installation is scheduled for completion in 1976.

LOWER GRANITE DAM

Recommendation. During formulation of the U.S. Fish and Wildlife Service Impact Report on the project, the Walla Walla District, Corps of Engineers recommended that a report be prepared covering the effects of the four lower Snake River projects on fish and wildlife resources of the area with recommendations on measures necessary to compensate for losses caused by the four-dam project.

Action. During construction of the project, adult and downstream migrant fish passage facilities are being included at a cost of approximately \$11,000,000. These facilities are planned to include traveling screens in the intakes of the three operating units and the three additional units when they are completed to divert a large portion of the downstream migrating salmonids into a bypass system for collection and transport or diversion around the powerhouse to the river below the dam. Spillway deflectors for reduction of nitrogen supersaturation have been constructed in all spillway bays.

In addition to project features, construction of Lower Granite Dam required removal of Washington Water Power Dam spillway at Lewiston, Idaho, which restored five miles of the lower Clearwater River to a free-flowing condition. During the construction phase six subimpoundments totaling about 250 surface acres which can be managed for trout or warm-water fisheries were created behind railroad and highway relocations, and seven islands were constructed for goose nesting purposes. The reservoir clearing contract was modified so that emergent vegetation between elevations 728 and 738 msl (normal pool) was left standing to provide habitat for warm-water fish. Development of the emergent lands on the Clearwater River will include features for wildlife management.

Efforts to maintain the anadromous fish resources at the Lower Snake River Project have cost approximately \$52 million to date, including initial construction costs and research development. Thus, it can be seen that an effort to prevent fish and wildlife losses has already been made. In spite of this effort, it has become apparent that losses to the fish and wildlife resources are still occurring. As a result of increased knowledge of the effects of these dams on the fish and wildlife resources of the area developed between 1962 when Ice Harbor was completed and 1966 when the comprehensive report was requested, it was concluded that more extensive compensation requirements existed beyond those recommended in the initial reports.

A draft of the Bureau of Sport Fisheries and Wildlife-National Marine Fisheries Service Report covering the impact of the whole Project was received by letter of 3 February 1971 for internal review and comment. By letter of 24 March 1971 comments on this draft were submitted to the Bureau of Sport Fisheries and Wildlife for their consideration. A second draft was received by letter of 13 December 1971 and comments were returned to the Bureau on 2 March 1972. These comments were concerned mainly with the lack of data in the draft to justify the size and type of recommended compensation features. The final report, signed by the Directors of the Bureau of Sport Fisheries and Wildlife and the National

Marine Fisheries Service, entitled "A Special Report on the Lower Snake River Dams, Ice Harbor, Lower Monumental, Little Goose, Lower Granite," dated September 1972, was received by the Walla Walla District on 4 November 1972. This report was prepared through the cooperation of the above two Federal agencies and the five fish and wildlife agencies of the States of Oregon, Washington, and Idaho. The report is attached as Appendix A. Subsequent to receipt of this report, meetings were held with the technical staffs and the directors of the agencies to discuss the recommended compensation features. Additional justification data were furnished as a result of these meetings and a supplemental report on the fishery portion, prepared by the Fish Commission of Oregon, is attached as Appendix B. Supplemental data on the wildlife portion are included in the text of this report.

The Walla Walla District was instructed by the Office, Chief of Engineers that independent consultant services should be obtained to review and analyze the compensation report prepared by the fish and wildlife agencies, and that an environmental impact statement on the effects of the proposed compensation measures be prepared prior to submission of the District Engineer's report to higher authority for approval.

A preliminary draft report dated 13 April 1973 was prepared by the District Engineer and later revised in September 1973, based on additional data furnished by the agencies and on input from four public meetings held in May and July 1973. The final report of the fish and wildlife agencies and the revised draft report were furnished to the consultants for their consideration. The reports furnished by these consultants essentially concurred with the recommendations of the fish and wildlife agencies.

The data used in preparation of this final report by the Walla Walla District, Corps of Engineers have been furnished by the concerned State and Federal fish and wildlife agencies, whose efforts and cooperation in this matter have been most helpful, and from the independent reports of the Corps' fisheries consultant, Appendix C, and the wildlife consultant, Appendix D.

Independent of this report, the Walla Walla District has contracted for separate consultant services to prepare a wildlife habitat management plan to outline those areas and methods which will provide maximum replacement possible of wildlife and wildlife habitat on already owned project lands in the lower Snake River area. This report is being processed as a separate project design memorandum. The estimated proportion of total compensation to be realized on Project lands is considered in the development of plans and recommendations for off-project lands.

PROJECT IMPACTS ON ANADROMOUS AND RESIDENT FISH

PRE-PROJECT CONDITIONS

The Snake River system is one of the outstanding river systems in the United States for production of fish and supports large populations of both anadromous and resident species. Anadromous fish from the Snake River system, particularly Chinook salmon, contribute substantially to the large commercial and sport fisheries in the Columbia River and the Pacific Ocean from California to Alaska. Salmon and steelhead trout support an extensive sport fishery throughout the lower Columbia and Snake Rivers and tributaries, a limited commercial fishery below Bonneville Dam, and an Indian commercial fishery above Bonneville Dam. An excellent sport fishery for anadromous as well as resident species existed in the Project area prior to Project construction. No actual count of the numbers of anadromous fish entering the Snake River was possible until the completion of Ice Harbor Dam in 1962. Table 1 shows the McNary and Ice Harbor Dam counts since 1962 and the percentage of the Columbia River fish (McNary count) entering the Snake River (Ice Harbor count).

Principal resident game fish in the Project area are smallmouth and largemouth bass, white sturgeon, and channel catfish. Other less important species to the fishery are rainbow trout, Dolly Varden, brown bullhead, mountain whitefish, white crappie, and bluegill. Nongame fish include carp, squawfish, suckers, chiselmouth, and shiners.

TABLE 1

NUMBER AND PERCENT OF CHINOOK SALMON AND STEELHEAD TROUT
COUNTED AT MCNARY DAM PASSING ICE HARBOR DAM

Year	Spring & Summer Chinook		Fall Chinook		Steelhead	
	McNary Number	Ice Harbor Number %	McNary Number	Ice Harbor Number %	McNary Number	Ice Harbor Number %
1962	108,640	64,252 59.1	44,116	30,049 68.1	163,181	115,796 71.0
1963	97,096	47,653 49.1	57,363	13,537 23.6	113,646	74,539 65.6
1964	109,341	49,000 45.1	58,593	11,097 18.9	100,742	58,860 58.4
1965	74,581	26,879 36.0	76,326	12,345 16.2	118,960	62,873 52.9
1966	148,022	60,864 41.1	75,119	15,018 20.0	145,130	65,798 45.3
1967	122,566	65,908 53.7	73,087	19,022 26.0	77,700	44,205 56.9
1968	127,731	74,304 58.2	72,757	24,377 33.5	112,522	82,383 73.2
1969	134,032	83,007 61.9	79,375	17,507 22.1	76,681	63,889 83.3
1970	107,338	67,313 62.7	61,554	10,385 16.9	69,759	53,870 77.2
1971	101,730	59,244 58.2	69,718	11,004 15.8	109,630	67,029 61.1
1972	119,514	73,196 61.2	49,307	9,436 24.4	93,820	63,593 67.7
1973	110,859	73,468 66.3	73,253	8,353 11.4	64,620	38,311 59.3
1974	65,849	29,630 45.0	62,009	2,814 04.5	26,932	12,528 46.5
Average	109,792	59,593 54.3	65,583	14,226 21.7	97,948	61,821 63.1

SIZE OF ANADROMOUS FISH RUNS

Basic to any determination of project impact is a knowledge of the pre-project population sizes. Because an actual count of anadromous fish into the Snake River was not possible prior to the completion of Ice Harbor Dam in 1962, determination of the pre-project run sizes has been estimated by the Northwest fisheries agencies. One estimate of representative run sizes was based on the maximum counts at McNary Dam from 1954 to 1967 and the maximum percentage of the McNary count passing over Ice Harbor Dam from 1962 to 1967. The fishery agencies regard this approach as reasonable in that substantial numbers of steelhead migrate upriver during noncounting periods and because higher counts of Chinook salmon occurred at McNary Dam prior to completion of Ice Harbor in 1962 than occurred after completion. Table 2 summarizes the fishery agencies' calculation of pre-project Snake River run sizes on this basis. Table 3 shows annual McNary Dam fish counts for the period 1954 through 1974.

Subsequent to receipt of the basic report of the Bureau of Sport Fisheries and Wildlife and National Marine Fisheries Service, and at the request of the Corps of Engineers for additional supporting information, the fish and game agencies developed an appendix to their basic report which discusses at length their rationale for estimating the pre-project run sizes into the Snake River. In their supplemental report, which is attached as Appendix B, the fish and wildlife agencies utilize a different approach to demonstrate that use of maximum McNary Dam counts as a basis for determining pre-project Snake River run sizes is justifiable.

First, the fishery agencies show that total dam construction in the Columbia Basin since the early 1950's has resulted in substantial reduction in total run sizes and that dam counts of some runs during this period have been artificially maintained at relatively high levels by

TABLE 2

ESTIMATED DISTRIBUTION OF SALMON AND STEELHEAD TROUT
RUNS TO SNAKE RIVER SYSTEM IN PERCENT AND NUMBER *

River Segment	Fall Chinook		Spring-Summer Chinook		Steelhead	
	Maximum Count	McNary Dam	Maximum Count	McNary Dam	Maximum Count	McNary Dam
	97,500 (1958)	Distribution	222,100 (1957)	Distribution	172,600 (1962-63)	Distribution
	Percent	No. Fish	Percent	No. Fish	Percent	No. Fish
Snake River						
Lwr. Monumental-China Gardens (main stem spawning)	26.5	17,600			4.0	4,600
Tucannon River						
Clearwater River	0.5	300	2.0	2,400	3.0	3,400
Asotin Creek			0.5	600	37.5	43,200
Grande Ronde River					1.5	1,700
Snake River:			10.0	12,200	14.0	15,900
China Gardens-High Mtn. Sheep	5.5	3,600				
Salmon River			79.5	97,200	30.5	35,200
Imnaha River	0.5	300	5.5	6,700	3.5	4,000
Snake River:						
High Mtn. Sheep-Appaloosa	1.5	1,100				
Appaloosa-Pleasant Valley	5.5	3,600				
Pleasant Valley-Hells Canyon	33.0	22,000				
Hells Canyon Dam Fish Facilities	27.0	17,800 ^{4/}	2.0	2,500	5.0	5,700
Small Tributaries:						
Imnaha River-Hells Canyon Dam	100.0	66,300 ^{1/}	0.5	600	1.0	1,100
			100.0	122,200 ^{2/}	100.0	114,800 ^{3/}

1/ McNary Dam maximum count 97,500 x 68% = 66,300 (rounded to nearest 100) (68% is the highest percent of McNary counts over Ice Harbor 1962-67.)

2/ McNary Dam maximum count 222,100 x 55% = 122,200 (rounded to nearest 100) (55% is the highest percent of McNary counts over Ice Harbor 1962-67.)

3/ McNary Dam maximum count 172,600 x 66.5% = 114,800 (rounded to nearest 100) (66.5% is the highest percent of McNary counts over Ice Harbor per fish year 1962-67 adjusted to include estimates of fish migrations during months when no counts were made.)

4/ The highest count at Oxbow Dam (1958) prior to construction of Hells Canyon Dam. This includes 3,497 known mortalities downstream from the dam in October.

Note: Counting period breakdown: Fall chinook..... August 9 to October 31

Spring-summer chinook..... April 1 to August 8

Steelhead..... July 1 to June 30

* Table based on data available through 1967 and does not reflect distribution that could occur within any section or tributary in any given year.

TABLE 3
NUMBER OF CHINOOK SALMON AND STEELHEAD TROUT COUNTED AT
MCNARY DAM 1954 - 1972

<u>Year</u>	<u>Spring and Summer Chinook</u>	<u>Fall Chinook</u>	<u>Steelhead Trout</u>
1954	113,079	13,476	75,059
1955	92,489	16,426	85,575
1956	103,052	11,290	42,554
1957	222,089	70,607	105,728
1958	128,564	97,528	87,890
1959	115,760	55,730	110,475
1960	129,430	47,337	96,895
1961	113,796	41,200	103,743
1962	108,640	44,116	163,181
1963	97,096	57,363	113,646
1964	109,341	58,593	100,742
1965	74,581	76,326	118,960
1966	148,022	75,119	145,130
1967	122,566	73,087	77,700
1968	127,731	72,757	112,522
1969	134,032	79,375	76,681
1970	107,338	61,554	69,759
1971	101,730	69,718	109,630
1972	119,514	49,307	93,820
1973	110,859	73,253	64,620
1974	65,849	62,009	26,932

severe reduction in fishery harvest. Summer Chinook counts have fallen drastically, even though there has been no fishery since 1964. Thus, the use of recent Snake River dam counts to determine the average annual Snake River run sizes prior to project construction would reflect depressed run sizes caused by lower Columbia River projects and produce an artificial and unreliable estimate.

The fisheries agencies then developed a case to show that if McNary and other dams constructed since 1954 had not been built, and with sound management of the runs to achieve an optimum sustained yield, average sustainable returns to the Columbia River would approximate the actual maximum returns to the river during the 1950's. From this it is demonstrated then that use of actual maximum McNary Dam counts during the time span the actual maximum return to the river occurred provides a reasonable approximation of the escapement needed past McNary to produce an annual run of optimum size.

In the development of this case the agencies utilize average return-per-spawner* rates for an 11-year period prior to completion of McNary Dam and multiply this rate by the optimum escapement values, developed in the late 1950's by actual management research, to achieve the average optimum run size. Thus, development of the optimum figures does inherently include an averaging process and a built-in damage factor for projects constructed prior to 1954. Tables 4 and 5 illustrate the development of the optimum run figures.

In their development of pre-Lower Snake River Project fish run sizes into the Snake River the fishery agencies applied maximum percentage of the individual runs past McNary Dam that entered the Snake and were counted over Ice Harbor Dam for the years 1962 through 1967. During this period a large percentage of the fish passing McNary Dam was unaccounted

* Return-per-spawner is defined as the run size (Bonneville count plus the catch in the Columbia River below Bonneville) divided by the escapement (Bonneville count minus commercial and Indian catches above Bonneville Dam).

TABLE 4

BASIC COLUMBIA RIVER SALMON AND STEELHEAD DATA FOR
ESTIMATING THE PRODUCTION RATES (RETURN PER SPAWNER) FOR
THE 11 BROOD YEARS PRECEDING THE COMPLETION OF McNARY DAM AND
THE 11 BROOD YEARS AFTER THE COMPLETION OF THE DALLES DAM

<u>Period</u>	<u>Parameter</u>	<u>Salmon</u>			<u>Summer Steelhead</u>
		<u>Spring Chinook</u>	<u>Summer Chinook</u>	<u>Sockeye</u>	
	Avg escapement (1942-52)	52,400	37,900	49,100	95,600
Pre-McNary- The Dalles brood years (1942-52)	Avg run size (Salmon: 1946-56)	187,300	105,100	195,900	
	(Steelhead: 1947-57)				259,600
	Return per spawner	3.57	2.77	3.99	2.72

	Avg escapement (1957-67)	83,200	82,500	72,500	130,000
Post-McNary- The Dalles ^{1/} brood years	Avg run size (Salmon: 1961-71)	172,500	94,500	100,400	
	(Steelhead: 1962-72)				200,800
	Return per spawner	2.07 ^{1/}	1.15	1.38	1.54

^{1/} Production in these years was also influenced in varying degrees by other dams: Brownlee (1953); Priest Rapids (1960); Oxbow (1961); Rocky Reach (1961); Ice Harbor (1962); Wanapum (1963); Wells (1967); Hells Canyon (1967); John Day (1968); Lower Monumental (1969); and Little Goose (1970). (Source: Fish and Wildlife Agencies Supplement Report Appendix B).

TABLE 5

COMPUTATION OF AVERAGE YEARLY LOSS TO COLUMBIA RIVER FISHERIES
 BASED ON DIFFERENCE BETWEEN OPTIMUM YIELD ^{1/} AND CURRENT YIELD

Period	Parameter	Salmon			Summer Steelhead
		Spring Chinook	Summer Chinook	Sockeye	
Pre-McNary- The Dalles	Average optimum run	285,600	221,600	319,200	326,400
	Optimum escapement	80,000	80,000	80,000	120,000
	Optimum sustainable yield (difference)	<u>205,600</u>	<u>141,600</u>	<u>239,200</u>	<u>206,400</u>

Current	Average run > (Table 4)	172,500	94,500	100,400	200,800
	Average escapement > 1968-72	115,400	74,800	68,700	129,800
	Average sustainable yield (difference)	<u>57,100</u>	<u>19,700</u>	<u>31,700</u>	<u>71,000</u>

Average yearly loss to fisheries (difference between yields)		<u>148,500</u>	<u>121,900</u>	<u>207,500</u>	<u>135,400</u>

^{1/} Optimum yield is average yearly harvest that could have been taken by fisheries if McNary and subsequent dams had not been constructed.

Source: Fish & Wildlife Agencies Supplemental Report (Appendix B)

for or lost before reaching the next upstream dams (Ice Harbor on the Snake River and Priest Rapids on the Columbia River). A study by the Fish Commission of Oregon in 1966, under contract to the Corps, indicated losses as high as 41 percent for spring Chinook and 45 percent for steelhead. Improved operational conditions starting in 1968 at Ice Harbor Dam greatly reduced these losses and, except for fall Chinook which will be discussed later, average percent passage at Ice Harbor of McNary counts for the years 1968 to 1973 was actually larger than the maximum values used by the fishery agencies in computing the required compensation. See Table 6.

Further credence for the use of maximum McNary count figures and maximum percents of McNary counts arriving at Ice Harbor as a basis for estimating pre-Ice Harbor run sizes is provided by the fact that this method has been accepted by all parties in Federal Power Commission proceedings pertinent to a number of projects in the middle Snake River area.

ANADROMOUS FISH SPAWNING GROUNDS

The Bureau of Sport Fisheries and Wildlife-National Marine Fisheries Service Report indicates that about 5,000 fall Chinook spawned in the Snake River below the mouth of the Clearwater River prior to project construction. Accurate counts of the actual numbers of fish spawning in this stretch of river have not been made because the water was too turbid for observation. Estimates appear to have been made, at least in part, on the basis of early surveys to catalog areas possessing necessary spawning ground requirements such as gravel availability and proper depths, water velocities, and temperatures.

STEELHEAD SPORT FISHERY

Prior to construction of the project, the lower Snake River supported the largest summer run steelhead fishery in the State of Washington. With

TABLE 6

COMPARISON OF AVERAGE AND MAXIMUM PERCENT PASSAGE
McNARY AND ICE HARBOR DAMS

	<u>Spring & Summer Chinook</u>	<u>Steelhead</u>
McNary Average Count 1968 - 1973	116,867	87,839
Ice Harbor Average Count 1968 - 1973	71,755	61,512
Actual Percent Passage over Ice Harbor 1968 - 1973	61%	70% ^{1/}
Maximum Percent Passage at Ice Harbor (as used in FWS-NMFS Report, Appendix A)	55%	66.5%

^{1/} Average percent of McNary count passing Ice Harbor in years following 1967 exceeded "maximum" used by fish and game agencies.

the project, favorite rapids and pool areas have been changed to large, deep lakes and previous methods of fishing for these large trout are no longer effective except in the tailrace areas immediately below the dams. It has been estimated by the fish and wildlife agencies that about 130,000 angler-days annually would have been expended on steelhead fishing in the project area during the 100-year project life, which will be lost because of project construction.

RESIDENT SPORT FISHERY

The Washington Department of Game has conducted evaluation studies on the lower Snake River resident sport fishery since 1964. Based on these studies, the project long-term estimate for angler-day use in the four-dam area during the project life would have been 250,000 days annually for resident fish without construction of the project.

PRESENT PROJECT CONDITIONS

The major effects which construction of the four dams on the lower Snake River has had on fish include the conversion of a flowing stream into a reservoir-type habitat, the inundation of main stem spawning areas for some fall Chinook, and the addition of four substantial obstructions and sources of loss and damage to upstream and downstream migrants. The change from a stream to reservoir conditions has, of course, also substantially altered the character of the sport fisheries for anadromous and resident fish in the project area.

ANADROMOUS FISH RUN LOSSES

The Bureau of Sport Fisheries and Wildlife-National Marine Fisheries Service Report discusses a number of possible sources of loss to the anadromous fish runs at the lower Snake River dams, including losses of juveniles in turbines; losses to adults in seeking, entering, and passing

through the fishway system at each dam; losses of juveniles stunned in passing through turbines and spillways to increased predation; losses of juveniles through increased predation caused by creation of reservoirs which are more conducive to predator production; possible losses of juveniles through delay in reaching the sea as a result of having to migrate through reservoirs rather than moving to the sea in a fast-flowing stream; losses of juveniles and adults from nitrogen supersaturation; and, of course, loss of total production through the inundation and loss of spawning grounds. The fish and wildlife agencies stress the fact that compensation for nitrogen-related losses is not a part of this current program and acknowledge that other ongoing programs of the Corps are dedicated to minimizing supersaturated nitrogen as a major source of loss. The other sources of loss, except for spawning ground inundation and turbine losses, are not quantified but only discussed in general terms. Spawning ground inundation and loss is quantified in the fish and wildlife agencies report, at 5,000 fall Chinook salmon. Beyond this, the entire plan for anadromous fish propagation facilities is based on a 48-percent cumulative loss to juvenile downstream migrants passing through the turbines of the four lower Snake River dams.

Thus, of 66,300 fall Chinook, 122,200 spring and summer Chinook, and 114,800 steelhead calculated in Table 2 to have entered the Snake River prior to Project construction, some 34,400 fall Chinook, 58,700 spring and summer Chinook, and 55,100 steelhead are alleged to have been lost as a result of Lower Snake River Project construction. Table 7 summarizes these loss figures and their values.

ANADROMOUS SPORT FISHERY LOSSES

Based on creel census studies and punch card returns, the fish and wildlife agencies estimate that without the Project 130,000 average annual fisherman-days would be spent stream fishing for steelhead in the Project area during the Project life. They further estimate that the conversion of this reach of river into a series of reservoirs will completely eliminate these 130,000 average annual stream fisherman-days for steelhead.

TABLE 7

COMMERCIAL LANDINGS AND SPORT FISHING USE, WITH AND WITHOUT COMPENSATION ^{1/} IN COLUMBIA RIVER SYSTEM AND PACIFIC OCEAN
(ANADROMOUS SPECIES) AND IN LOWER SNAKE RIVER PROJECT AREA (RESIDENT SPECIES)

Areas and Species	Commercial Fisheries						Sport Fisheries 4/									
	With Compensation			Without Compensation			Difference			W/Comp.			WO/Comp.			
	Landings		Escapement	Landings		Escapement	Landings		Escapement	Landings		Escapement	Ang. Days		Ang. Days	Diff.
	Pounds	Value		Pounds	Value		Pounds	Value		Pounds	Value					
Columbia R. System, Ocean																
Fall Chinook 2/	32,700	1,668,000	\$1,651,320	14,400	734,000	\$ 726,660	18,300	934,000	\$ 924,660	163,500	72,000	91,500				
Spring and Summer Chinook 2/	122,200	6,232,000	6,169,680	63,500	3,238,000	3,205,620	58,700	2,994,000	2,964,060	611,000	318,000	293,000				
Steelhead 3/	114,800	692,000	380,600	59,700	360,000	198,000	55,100	332,000	182,600	763,000	397,000	366,000				
Totals	269,700	8,592,000	\$8,201,600	137,600	4,332,000	\$4,130,280	132,100	4,260,000	\$4,071,320	1,537,500	787,000	750,500				
L. Snake Project Area																
Resident										250,000	205,000	45,000				

^{1/} Insofar as possible "with compensation" is intended to reflect the preproject condition.

^{2/} Calculations based on catch to escapement ratio of 4:1 (commercial catch 3:1 and sport catch 1:1) average weight per fish of 17 lbs.; and commercial value of \$0.99 per lb. for Chinook, based on 1973 prices.

^{3/} Calculations based on catch to escapement ratio of 2:1 (commercial catch 0.67:1 and sport catch 1.33:1); average weight per fish of 9 lbs.; and commercial value of \$0.55 per pound, based on 1973 prices.

^{4/} Angler-days for anadromous fish are based on catch to escapement ratios (footnotes 2 and 3) and an estimated 5 days of effort per fish (the value of an angler-day for anadromous fish is \$9.00). Angler-days for resident fish are based on creel studies of Washington Department of Game and the ratio of 3 reservoir angler-days to 2 stream angler-days.

From BSAW-NMFS Report (Appendix A) as revised by correspondence.

RESIDENT SPORT FISHERY LOSSES

Prior to dam construction the Snake River resident fish species most important to anglers were smallmouth bass, channel catfish, sturgeon, and whitefish. These species are dependent upon a live flowing stream environment. Their size, abundance, and fishing characteristics generated an intensive sport fishery in the Project area. Project completion created large reservoirs more favorable to other species. The Bureau of Sport Fisheries and Wildlife's joint report with the National Marine Fisheries Service states, "the without project resident fishery would have averaged 250,000 angler days. The average with project fishery will be 205,000 days, a loss of 45,000." Later correspondence indicated that compensating only the 45,000 angler-days lost is, in fact, insufficient. Loss of fishery quality must be compensated for. The report infers this quality aspect in stating, "the loss is actually greater than the 45,000 difference because two stream-angler days are equivalent to three reservoir-angler days in value." The resident fishery decline, therefore, amounts to 67,500 angler-days.

FISH AND WILDLIFE AGENCIES' RECOMMENDED COMPENSATION MEASURES FOR FISHERIES LOSSES

ANADROMOUS FISH RUNS

To achieve compensation for reduced anadromous fish production caused by the Lower Snake River Project, the fish and wildlife agencies have recommended fish propagation facilities. Their sizes and costs are based on loss level discussed above and on the factors shown in Table 8. These are hatchery facilities that would return 18,300 adult fall Chinook, 58,700 adult spring and summer Chinook, and 55,100 adult steelhead trout to the Snake River above the project area. The basic report of the agencies recommended a fall Chinook hatchery sized to return a run of 34,400 adults based on the maximum count at Ice Harbor Dam. This single

TABLE 8

HATCHERY REQUIREMENTS NECESSARY TO PRODUCE THE REQUIRED NUMBERS
OF ADULT CHINOOK SALMON AND STEELHEAD TROUT
(Northwest Fish & Wildlife Agencies)

	Fall Chinook	Spring & Summer Chinook	Summer Steelhead
Adult Loss Level for Basing Hatchery Size	18,300 ^{1/}	58,700	55,100
Percent Survival, Smolt to Adult	0.20	0.87	0.50
Number of Smolts	9,160,000	6,750,000	11,020,000
Smolts per Pound (Weight)	90	15	8
Pounds of Smolts ^{2/}	101,800	450,000	1,377,500
Percent Survival, Eggs to Smolt	80	70	65
Number of Eggs Needed	11,450,000	9,650,000	16,950,000
Eggs per Female	5,000	4,500	5,000
Number of Females Needed	2,290	2,145	3,390

1/ Reduced figure derived through negotiation between Corps and fish and wildlife agencies.

(The 66,300 and 34,400 figures are based on the highest percent of McNary count to enter Snake (some 68%). While this was an actual figure, it was twice as high as the next highest percent of McNary count to enter the Snake (33.5%). Thus, the second highest level was used as being more representative: $[97,500 \times 33.5\%] - 5,000 \times 48\% + 5,000 = 18,300$.)

2/ Pounds of smolts reared is the most significant item, both with respect to hatchery cost and eventual adult production. Size and numbers may be adjusted to hatchery practice.

year count was excessively high in comparison with other annual counts so the size was reduced to 18,300 adults by separate correspondence based on the second highest annual count as being more representative of the actual Snake River run.

ANADROMOUS SPORT FISHERY

To compensate for the loss of 140 miles of stream-type fishing for steelhead, the fish and wildlife agencies have recommended the acquisition of 150 linear miles of streamside lands averaging 100 feet in width along such streams as the Grande Ronde, Salmon, Clearwater, Tucannon, and Main Snake Rivers for assured fisherman access.

LOWER SNAKE RIVER RESIDENT SPORT FISHERY

Based on a revised estimated loss of 67,500 stream angler-days and a "put-and-take" trout fishery for compensation, the fish and wildlife agencies recommend trout propagation facilities capable of producing annually 233,000 trout weighing 93,000 pounds. These legal-size fish would be planted in southeastern Washington and western Idaho streams tributary or near to the Snake River, such as Asotin Creek and Touchet, Walla Walla, Tucannon, and Clearwater Rivers.

DISCUSSION

ANADROMOUS FISH RUNS

The entire matter of measuring damage levels to multiple stocks of fish in the Columbia River Basin and assigning specific increments of loss to the many individual projects in the basin is extremely complex and difficult. Actual data to accomplish this directly are limited at best and it is necessary to use the information that does exist in a reasonable manner to achieve reasonable estimates of loss. In spite of the best efforts possible, the presentation of such material may appear

incomplete and confusing to some. However, in this case it is believed that sufficient information does exist to form a reasonable basis for future detailed planning and action. This belief is further supported in the fishery consultant's report (Appendix C) which basically states that the fishery losses claimed and compensation measures recommended by the agencies are reasonable and justified.

The basic reason for this report is, of course, the concern over losses to the fisheries of the spawning stock of fish that must pass upstream and the juvenile offspring which must pass downstream through the Lower Snake River Project area. In their supplemental report, Appendix B, the fish and wildlife agencies did demonstrate that a substantial drop in the return-per-spawner rate had occurred since 1952 in the Columbia River system (see Table 4) due to the impacts of all projects. The summer Chinook run is, at present, not maintaining itself. The agencies then applied these actual average return-per-spawner rates from before and after the construction of McNary and succeeding dams to optimum escapement figures developed through management experience to demonstrate annual losses to the fisheries. From all dam construction in the Columbia Basin since 1952 this annual loss is estimated to be about 270,400 spring and summer Chinook and 135,400 steelhead. When one considers the substantial numbers of spring and summer Chinook and summer steelhead that are produced in the Snake River system, it is reasonable to assume that the Lower Snake River Project plays a prominent role in the reduction of these runs.

The actual loss to the fishery in recent years is of particular concern. In order to provide adequate escapement levels to spawning areas, large inter-dam losses of adult fish have been countered by severely curtailing the commercial fisheries. This has been accomplished both by reducing the number of fishing days allowed and by permitting fishing only after a predetermined number of adults had been counted over Bonneville Dam. The sport fishery in the upper Snake River has also been

reduced because of these lower runs. In fact, because of the low steelhead run into the Snake River in fall 1974, no sport fishery was permitted on these fish in the States of Washington, Oregon, and Idaho.

Figure 2 illustrates the decline in number of fishing days since 1945. Figure 3 shows the decline in the actual commercial landings of spring and summer Chinook, sockeye, and summer steelhead for the same pre- and post-McNary years considered in Tables 4 and 5. It is clear that the landings of these species in the river have been reduced to less than half their former levels.

In addition to compensating for increasing losses of fish between dams, additional escapement has been allowed to compensate for pre-spawning mortalities occurring to fish after they have passed the uppermost dam. In the last four or five years many of these mortalities may have resulted from nitrogen gas bubble disease. However, pre-spawning mortality was observed during 1972 when nitrogen levels were relatively low because of river flow regulation by the Corps. Observations of fish on and below their spawning grounds indicated that delayed mortalities resulted from a high incidence of physical injury to fish passing dams. This pre-spawning mortality is illustrated by the declining number of spawning nests (redds) per 100 fish counted over the uppermost dam (see Figure 4).*

Published data on the commercial catch and escapement of spring and summer Chinook over Bonneville Dam, which constitutes the total run, are shown in Figure 5. As can be seen by these data, the catch, escapement, and total run maintained high levels in the early 1950's with the peak occurring in 1955. This high yield was due largely to screening of irrigation ditches, laddering of stream obstructions, and scientific management of the fisheries. Since 1955, the escapement above the commercial fishery has been kept relatively high by severely restricting the commercial catch and reduction of the sport fishery in the upper Snake River. In spite of this, the total run has declined. The period of this

* Redd counts supplied by the Idaho Department of Fish and Game.

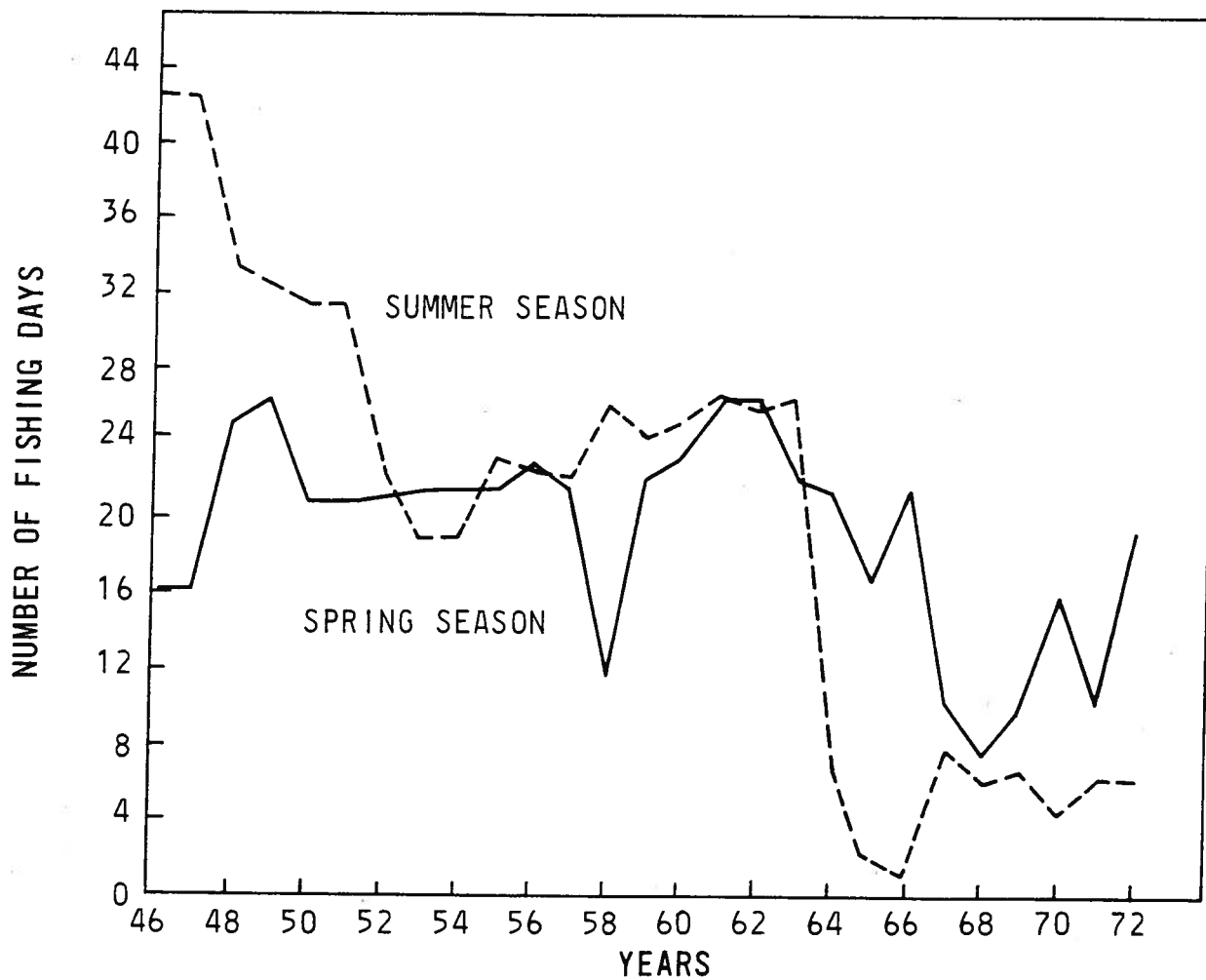


FIGURE 2. COLUMBIA RIVER COMMERCIAL FISHING SEASONS FOR SALMON BELOW BONNEVILLE DAM, 1946-72.

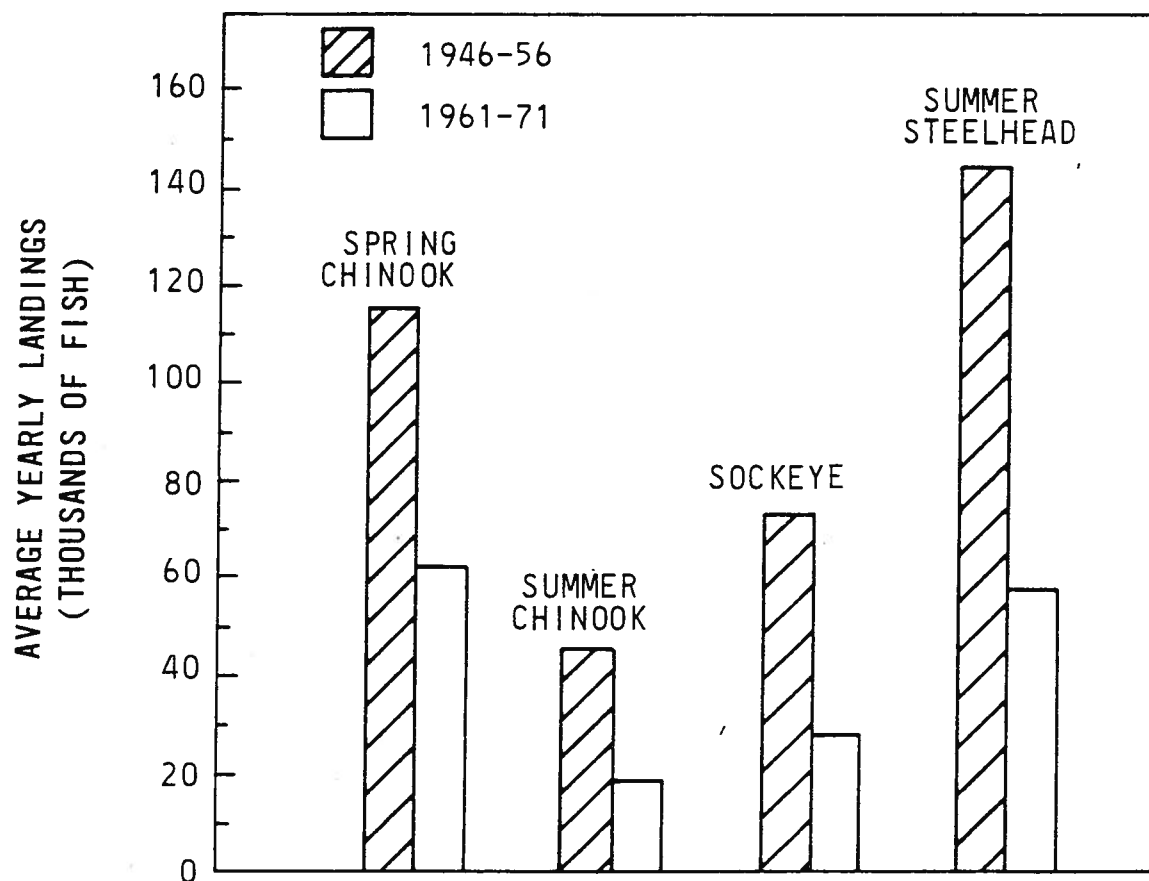


FIGURE 3. A COMPARISON OF AVERAGE ANNUAL COMMERCIAL LANDINGS IN THE LOWER COLUMBIA RIVER FOR THE YEARS 1946-56 AND 1961-71 OF SPRING CHINOOK, SUMMER CHINOOK, SOCKEYE, AND SUMMER STEELHEAD.

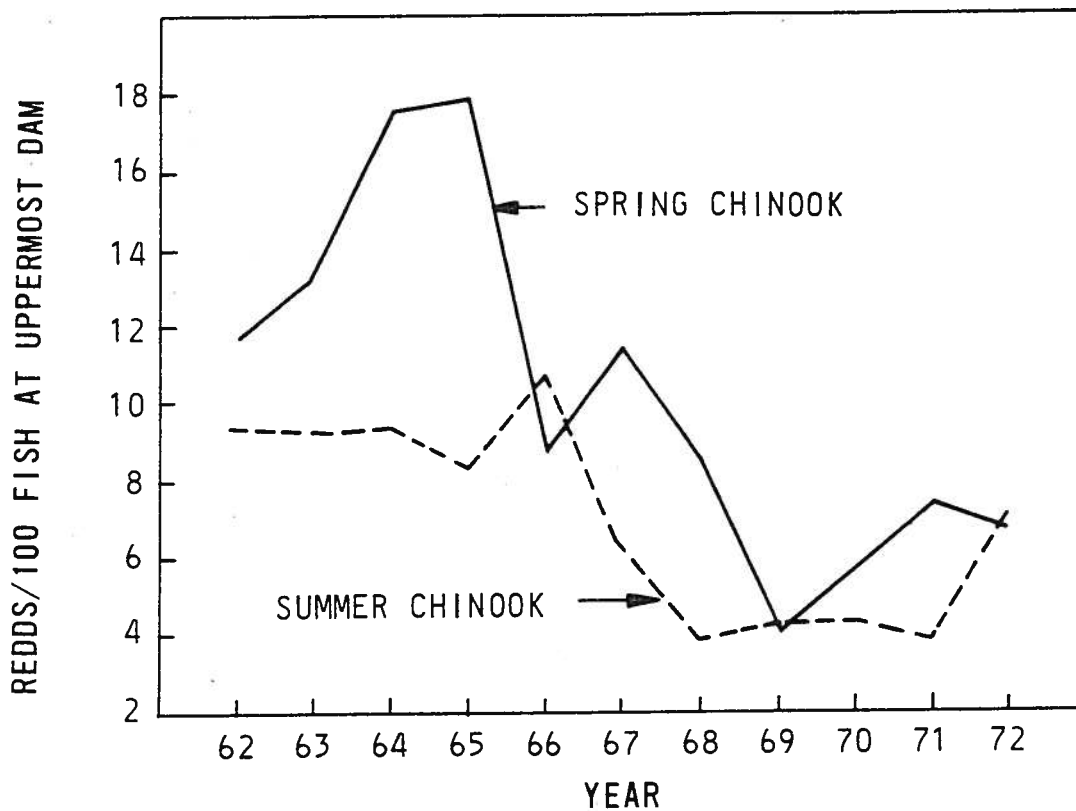
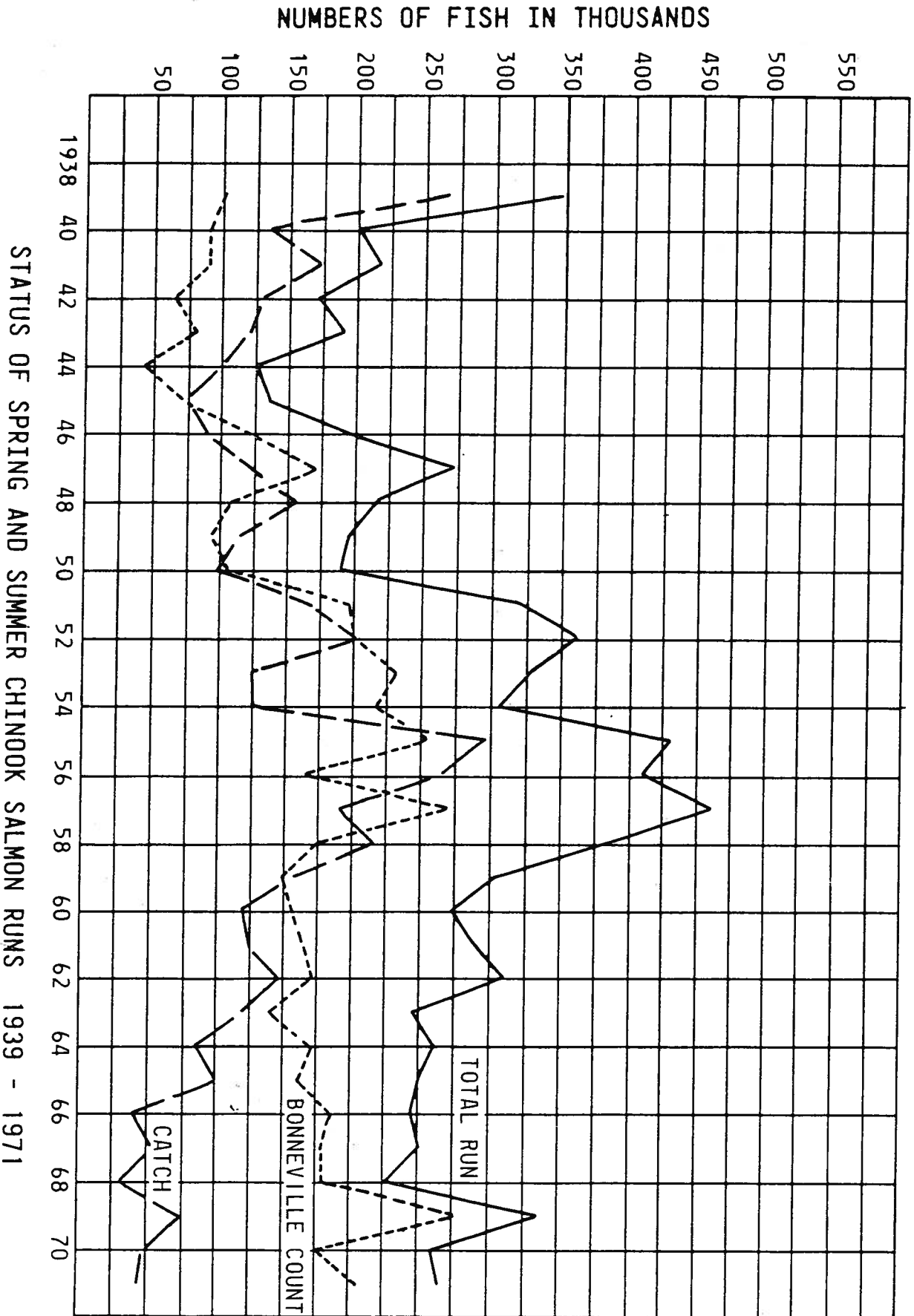


FIGURE 4. NUMBER OF REDDS IN STANDARD SPAWNING GROUND SURVEY UNITS IN IDAHO PER 100 FISH COUNTED OVER UPPERMOST DAM FOR SPRING AND SUMMER CHINOOK, 1962-72 ^{1/}

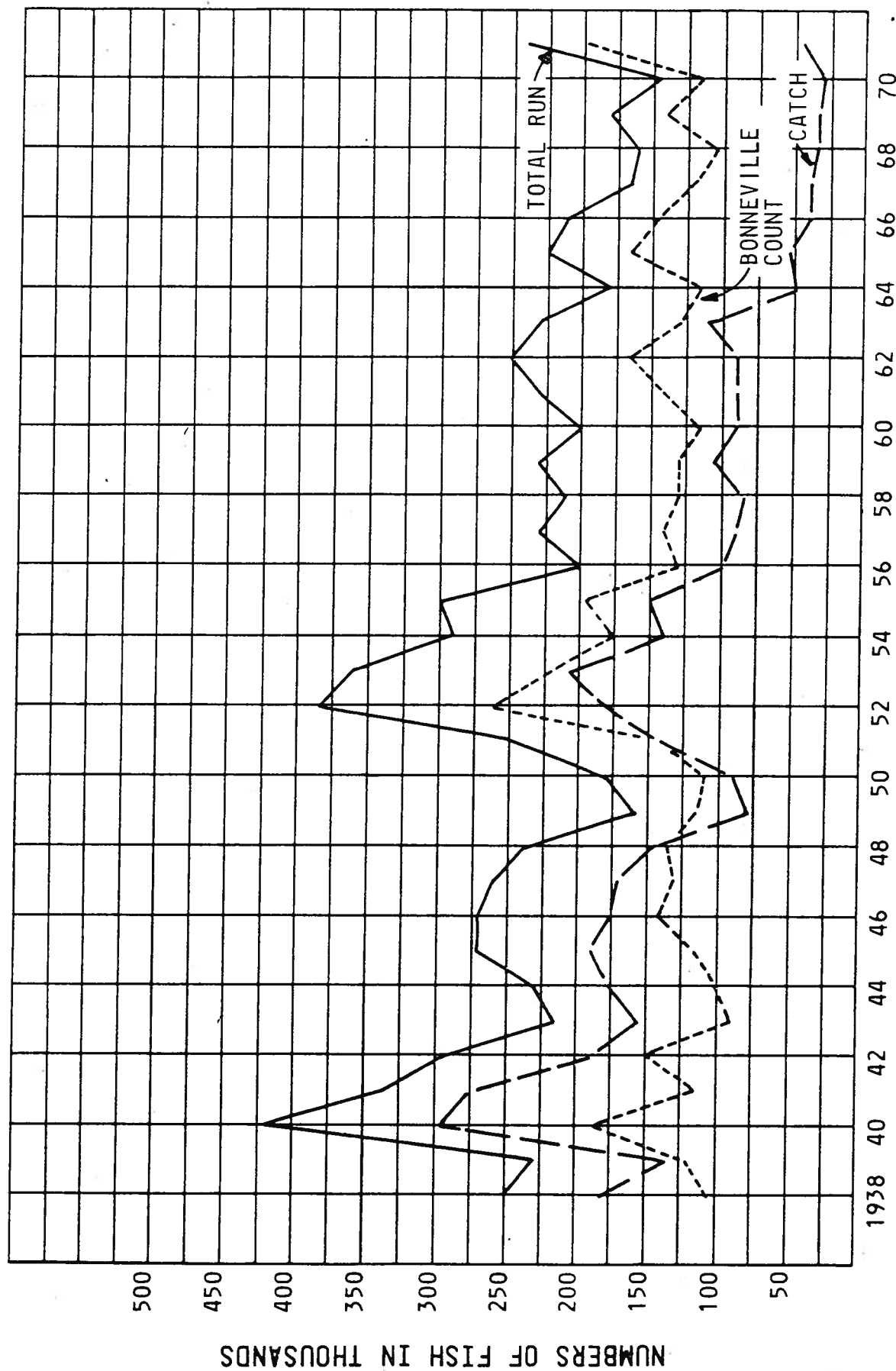
^{1/} REDD COUNT DATA SUPPLIED BY IDAHO DEPARTMENT OF FISH AND GAME.



decline has coincided with the period of major dam construction on the Snake and Columbia Rivers.

As with the spring and summer Chinook runs, the escapement of steelhead over Bonneville Dam has remained relatively constant but the commercial fishery on this species has been drastically reduced (see Figure 6). Historically, steelhead supported a sizeable commercial fishery in the Columbia River. Because of the declining runs and efforts of sport fishing groups, steelhead are now essentially a sport fish with only a limited commercial fishery below Bonneville Dam and an Indian commercial fishery above Bonneville Dam. According to estimates by the agencies, the sport fishery for steelhead has increased during this time with the estimated 52,000 angler-days annually occurring in the Lower Snake River Project area before construction, projected to an estimated 130,000 angler-days annually during the 100-year project life, without the project. Total catches of steelhead in the Columbia River system by both sport and commercial fishermen are down substantially compared to earlier years.

What should be most clear from the foregoing material is the magnitude of the fish losses in the Columbia River due to dams constructed in the last 20 years, and the inordinate hardship on the resource and the fisheries if reasonable compensatory procedures are delayed further. Losses due to Snake River projects have been increasing since the completion of Ice Harbor Dam in 1962, and serious losses related to main-stem Columbia River dams jumped sharply in the late 1950's and have continued year after year since that time. It could be argued that some of these losses result from environmental changes in tributary streams. However, during the period studied here, extensive screening of water diversions, other stream improvements, and increased hatchery production of spring Chinook and steelhead have countered most of the adverse effects occurring in these tributaries during this period. None of these latter activities are related to compensation for fishery losses at main-stem Corps projects.



STATUS OF STEELHEAD TROUT RUNS 1938 - 1971

Pro-rating total losses to individual projects on the basis of precise, factual information is not possible as necessary detailed data just do not exist. Fish counts by themselves are unreliable as they are an artifact of downriver fisheries management decisions and passage conditions at other dams. Substantial losses of adult fish between dams have been quantified for some projects; however, this does not appear to be a major source of loss in the lower Snake River. If damage to adult fish occurs at the lower Snake River dams, then the actual loss occurs between the uppermost dam and the spawning grounds and is not directly discernible in the lower Snake dam fish counts. As Figure 4 illustrates, however, there has been a substantial drop in the numbers of redds (spawning nests) produced by spring and summer Chinook in the Snake River watershed per 100 fish counted above the uppermost dam since Ice Harbor was completed in 1962. Lower Monumental was completed in 1969, Little Goose in 1970, and Lower Granite in 1975*. John Day Dam on the lower Columbia River was completed in 1968.

Nitrogen supersaturation at lower Snake dams may well contribute to the adult loss indicated above, but is unquantifiable at this time. Nitrogen supersaturation has been related to high quantified losses to juvenile salmonids at lower Snake dams; however, nitrogen losses are not claimed for compensation as a part of this plan. Another program to minimize or eliminate supersaturated nitrogen at lower Snake dams in progress by the Corps should ultimately eliminate most of the loss from this source.

The increased loss of juvenile salmonids to predation because reservoirs are more conducive to predator production is a generally accepted premise; however, this source of loss has not been quantified in the Columbia Basin to date. While this is probably a valid source of loss assessable to the Lower Snake River Project, it is not treated as such in this report.

* Pool raising date.

Possible loss of juvenile salmonids due to delay in reaching the sea due to the necessity of negotiating long slack-water areas created by impoundments rather than being moved quickly through the former stream environment by the spring freshet has been theorized but not demonstrated to date. Presumably the delay associated with increased exposure to impoundment and the possibility of arriving in the estuary at an inopportune time so far as food availability, predator exposure, and osmotic regulatory capability are concerned could result in increased losses. A portion of any such loss would be assessable to the Lower Snake River Project, but has not been treated as such in this report.

The entire anadromous fish loss attributable to the Lower Snake River Project in the report is based on the inundation of spawning grounds for 5,000 fall Chinook in the lower Snake by the Lower Snake River Project and the 48-percent loss of juvenile downstream migrant salmonids that would pass through the turbines of the four lower Snake River dams. Thus, the only possible source of confusion or error concerning appropriate allocation of total Columbia Basin dam losses to the Lower Snake River Project lies in the selection of a reasonable estimate of pre-project Columbia River fish run sizes at McNary and the selection of reasonable proportions of those runs that might be expected to enter the Snake River.

The 5,000 fall Chinook said to have spawned in the lower Snake is a fish and wildlife agency estimate based on limited evidence. Surveys some years ago revealed that extensive gravel areas were available and that depth, velocity, and water quality conditions were adequate for salmon spawning. Because of turbid water conditions, however, no quantitative, visual evidence of fall Chinook spawning in this area has been possible. Personal communication from one former fishery agency employee indicated that he had seen several redds on one flight in the mid-1950's and was sure there was some spawning in the area. However, since the completion of Lower Monumental and Little Goose dams, there is evidence that at least 5,000 fall Chinook spawned there even as recently as 1969. In 1969, of the 17,500 fall Chinook passing Ice Harbor Dam, only 7,600 were counted over Lower Monumental Dam. From 1970 through

1973 the average difference between Ice Harbor and Little Goose Dams has been 5,300 adult fall Chinook. Since we have already noted that no dam-related loss is attributable to passage in this area, it is reasonable to conclude that this difference represents fish formerly spawning in this area.

The basis for the 48-percent mortality to juvenile downstream migrants through the turbines is quite sound. Repetitive experiments involving the measurement of loss to juvenile fish in Kaplan turbines under head and other conditions similar to those at the lower Snake River dams have clearly demonstrated that a 15-percent loss rate at each of the four projects is a reasonable estimate. This 15-percent loss rate at each project includes direct turbine loss and some predation loss of fish stunned in the turbine. A progressive 15-percent loss rate to a group of downstream migrants at each of four projects, of course, results in a cumulative loss rate of 48-percent.

The Bureau of Sport Fisheries and Wildlife-National Marine Fisheries Service Report (Appendix A) recognizes the ongoing investigations by the National Marine Fisheries Service under the Corps of Engineers financing to reduce the loss of juvenile downstream migrants through development of a feasible penstock screening and bypass system to minimize the numbers of juvenile fish that would otherwise pass through the turbines. Such a system could be installed at each dam or operated at an individual project in conjunction with trapping and hauling equipment to transport these fish around several dams. To date the work has shown that up to 80 percent of the available juvenile fish can be deflected into the by-pass-collection system and that improved survivals to adult returns can result from fish so trapped and hauled around seven dams. Recent experimental and development work has greatly reduced levels of impingement, descaling, and other fish damage to a point where screening, trapping, and hauling appears to be a viable method for reducing fish mortalities. Subsequent evaluations which will take into account the reduced mortalities attributable to the screening and bypass system or hauling operations will be balanced against increased mortalities due to effects on downstream migrants of expanded powerhouse construction and increased power peaking operations.

Recognizing that dam counts have their shortcomings as indicators of run size, particularly for periods of time prior to Project construction, one is, nevertheless, faced with the necessity of using them for lack of any alternative source of information. In this report the McNary counts and percent of fish counted past McNary that were subsequently counted at Ice Harbor are dominant factors in the calculation of damage level and size and cost of compensating propagation facilities for the Lower Snake River Project.

In reference to the McNary counts, the fish and wildlife agencies (see Table 1) used the 1958 fall Chinook count of 97,500, the 1957 spring and summer Chinook count of 222,100, and the 1962-63 steelhead year count of 172,600. Reference to Table 3 showing all of the McNary counts illustrates that these counts are not only the maximum counts, but that they are substantially higher than the next highest count. It is believed that those counts occurring in 1957 were the result of The Dalles Dam inundating Celilo Falls, eliminating the Indian fishery there and permitting much larger numbers of fish to move upstream. The 172,600-figure used for steelhead by the fish and wildlife agencies cannot be found in the official public documentation of annual fish counts. Reported figures for the same year are 164,864. If one added 4.5-percent to this count for winter passage when counting does not normally occur, then the 172,600-figure could be achieved. The 4.5-percent winter passage rate is reasonable as demonstrated by other actual winter counts.

A point for supporting the use of the high McNary count is the fact that these same figures have been agreed to as a basis for compensation of fisheries losses by owners and proponents of several hydroelectric projects in the middle Snake River area during various Federal Power Commission proceedings. Also, the Federal Power Commission has ordered the Idaho Power Company to compensate losses from their middle Snake River dams on the basis of the same maximum figures. Further, a theoretical case by the fish and wildlife agencies to illustrate the optimum sustained yield of the Columbia River runs under conditions existing prior to 1952 demonstrated that optimum production would

approximate maximum runs occurring since 1938. Information has been presented to show that the generally low runs prior to 1952 were due to improper fisheries management and regulation and to hundreds of unscreened diversions in the basin that trapped and led thousands of juvenile downstream migrant salmonids to their death in the agricultural expanses of eastern Oregon, Washington, and Idaho. These shortcomings have since been largely corrected. It must also be remembered that a number of sources of losses at the lower Snake dams have been identified but few of them can be quantified. This in itself tends to justify the use of maximum numbers where some quantification is possible in the development of an artificial case for pre-project run sizes. It is also the opinion of the consultant that the use of maximum numbers is justified in computing compensation measures.

Another important factor in establishing the Lower Snake River pre-project run size is the percent of fish passing McNary Dam that subsequently passed into the Snake (Ice Harbor count). The figures originally used by the fish and wildlife agencies (see Table 2) are 68 percent for fall Chinook, 55 percent for spring and summer Chinook, and 66.5 percent for steelhead. At the time these figures were selected, they too were apparently maximums. However, since 1968 average percent figures have exceeded these maximums for spring and summer Chinook and steelhead. Comparison of the percent figures used for spring and summer Chinook and steelhead with the annual percent figures for all years in Table 1 indicates that the selected figures are reasonable. The maximum percent figure of 68 percent for fall Chinook, however, appeared to be excessive and through negotiation with the fish and wildlife agencies agreement was reached to use the second highest percent figure from Table 1, 33.5 percent.

The remaining factor substantially influencing the size and cost of the propagation facilities is the percent of planted fish that return to the hatchery or its vicinity. The fish and wildlife agencies have used 0.20 percent for the fall Chinook hatchery, 0.87 percent for the spring

and summer Chinook hatchery, and 0.50 percent for steelhead. On the basis of experience to date, these figures appear reasonable for detailed planning purposes.

It has not been the purpose of the preceding discussion to minimize the difficult task of establishing a reasonable basis for compensation or to discount the methods utilized in this instance. Rather, this discussion intends only to point out the strengths and weaknesses of the methods used and to list the supporting facts and rationale as dispassionately as possible. These strengths and weaknesses are further discussed in the consultant's report (Appendix C) and while the consultant disagrees with certain of the computation methods, there is complete agreement on the basic premise that a serious loss to the fishery has and is still occurring. Even using different computation methods the extent of loss demonstrated is almost equal. The consultant's report emphasizes that no present method can give a precise figure because of the many uncontrollable variables involved. Fully recognizing that the sizes of the compensation propagation facilities for anadromous fish affected by the Lower Snake River Project have been developed by rather imprecise means, it is believed that the basic information furnished by the fish and wildlife agencies and discussed above is generally reasonable and accurate enough at this time to use as a basis for approval or authorization of the compensation program.

Following approval or authorization and initial funding, detailed planning of the propagation facilities would encompass review of all information including any pertinent new data, the success of the screening program in protecting fish, adult returns from the transportation program, steelhead propagation at Dworshak hatchery, adverse effects of expanded powerhouses and increased peaking operations, and any other information that would have a bearing on the size and cost of the facilities ultimately constructed.

There is a matter of urgency in proceeding with this plan. Anadromous fish produced in the area affected by the Project contribute substantially to both the sport, commercial, and Indian fisheries in

Oregon, Washington, and Idaho and an ocean sport and commercial fishery from California to Alaska. With adequate compensation for existing and continuing dam-caused losses, in conjunction with existing and future fishery management programs, this important resource can be maintained to the benefit of present and future generations. The process of obtaining reasonable compensation for Lower Snake River Project will require some period of time even if plans for hatchery construction are initiated immediately.

Because of the Columbia and Snake River dams, fishermen have already lost an accumulation of tens of millions of pounds of prime salmon and steelhead. The present compensation program is not addressed to these past losses but rather is aimed at reducing such losses in the future. Because of the fact that summer Chinook and wild spring Chinook runs are not supporting themselves now and the 1974 steelhead count into the Snake River indicates that run is also in jeopardy, further delay of the compensatory process could have a serious impact on the viability of the fish runs and the fisheries.

ANADROMOUS SPORT FISHERY

The fish and wildlife agencies have stated that the Lower Snake River Project will eliminate 140 miles of stream-type fishing for anadromous fish, causing the annual average loss of 130,000 fisherman-days during the Project life. They are recommending the acquisition of 150 linear miles of assured streambank access for fishermen on other unpounded streams in the area. The 130,000 fisherman-days figure is developed by making estimates of the current fishing intensity through creel census and punch card analysis and by applying population growth and fishing popularity factors. In recent years (1965-1969) summer steelhead catches in the lower Snake River have ranged between 10,800 and 14,500 fish and have accorded some 52,000 man-days of stream fishing pleasure annually. From year to year during this period of time, the lower Snake River has consistently ranked first or second among the top ten summer-steelhead-producing streams in the State of Washington. With the dams, tailrace fishing in the Project area for anadromous fish is popular and productive now and will probably increase if the runs can

be maintained. Thus, we cannot agree with the fishery agencies that all anadromous sport fishing in the Project area will be eliminated but there is no doubt that an extensive stream-type fishery has been lost. The 130,000 average annual fisherman-day figure does appear to be reasonable as a basis for detailed planning.

RESIDENT SPORT FISHERY

The estimated loss of 67,500 stream angler days for resident fish has been derived from creel census, population growth and fishing popularity data. This loss would be compensated by producing and planting 93,000 pounds of trout in southeastern Washington and western Idaho streams tributary or near to the Snake. The 93,000 pounds have been derived in the following manner on the basis of management experience in this area.

$67,500 \text{ angler days} \times 2.52 \text{ trout/day} = 170,000 \text{ trout harvested}$

$170,000 \text{ trout harvest} \times \frac{1000}{0.729} \text{ (harvest rate)} = 233,000 \text{ trout planted}$

$233,000 \text{ trout planted} \div 2.5 \text{ fish/pound} = 93,000 \text{ pounds}$

The figures furnished by the fish and wildlife agencies for resident fish loss compensation appear to be reasonable as a basis for detailed planning.

ALTERNATIVES TO THE PROPOSED ACTION

The compensation plan presented in this report contains features which are considered to hold the greatest potential for restoring fish and wildlife losses caused by construction of the four lower Snake River dams. The recommended actions contained in the fish and wildlife agencies' report were selected by the seven agencies involved: U.S. Fish and Wildlife Service, National Marine Fisheries Service, Washington Department of Fisheries, Washington Department of Game, Fish Commission of Oregon, Oregon Game Commission, and Idaho Department of Fish and Game, from a number of alternative actions based on their experience with these alternatives under various field and research conditions. During the preparation of that

report, 1966 to 1972, a thorough analysis of these various means was made. The final actions recommended in this report are the result of considerable coordination between the Walla Walla District Corps of Engineers and the fish and wildlife agencies, results of later research, reports from independent consultants who reviewed the data, and comments from the general public.

Representative alternative actions considered in formulation of the final recommendations are:

No Action - This does not meet the requirements of the Fish and Wildlife Coordination Act, and losses caused by project construction would still remain.

Removal of Dams - This is not feasible because of the money already spent for construction and the relinquishment of benefits derived from the projects.

Spawning Channels in Lieu of Hatcheries - This type of facility has exhibited limited success. They are not nearly as efficient as hatcheries from the production standpoint and would require considerably more land to produce an equal number of fish.

Locating Hatcheries Nearer the Mouth of the Columbia River - This would be a more efficient operation from the standpoint of obtaining adult spawning stock and reducing project-caused losses to both adult and juvenile fish. It would not, however, replace the loss in the upper river area where it occurred, nor would the fish be available to the sport, commercial, or Indian fishery from which they had been lost.

Subimpoundment for Reservoir Fishery - Creation and development of subimpoundments could replace some of the resident trout and warm-water sport fishery losses. Areas for development are very limited, however, and could not replace the loss of an extensive steelhead sport fishery. The rate of success for steelhead fishing in the reservoirs is very low. In order to replace this lost fishing opportunity, it is necessary to acquire guaranteed access to nearby steelhead fishing streams.

PLAN OF DEVELOPMENT

GENERAL

Based on the fish and wildlife agencies' estimates of loss caused by the Lower Snake River Project and recommendations for compensation, the following Plan of Development is proposed as a basis for general approval or authorization and funding and the expeditious prosecution of detailed planning for design and construction.

From data furnished by the fishery agencies, subsequent to receipt of their final report, size and location of the hatchery facilities is of major importance. This point is strongly emphasized also in the consultant's report. The integrity of individual stocks of fish native to a particular watershed should be preserved as much as possible. Much effort was wasted in the early days of fishery management by indiscriminate transfer of fish, in some cases, to the detriment of the fishery. Because of the incompatibility of some transplanted fishes with the environment, there are many instances in which both the transplanted fish and the native stocks have suffered near extinction. For this reason the fishery agencies have suggested the construction of several smaller hatcheries rather than a lesser number of large "super hatcheries".

As can be seen from the following descriptions of the required hatchery facilities, the cost-per-pound of production varies considerably from \$61 per pound for fall Chinook to \$25 per pound for spring and summer Chinook and \$15 per pound for steelhead trout. The exact hatchery locations have not been determined as yet so the cost of the facilities was based on single-species production for estimating purposes. The per-pound production cost for fall Chinook is considerably higher than for the other species because the young are reared for a short time only and released at a much smaller size. The more expensive hatchery components, such as buildings, incubators, water supply, and adult holding ponds are still required regardless of the size of fish released. In the actual siting of the hatcheries it may be possible to raise more than one species of fish at a given

facility thereby obtaining dual use of certain components and obtaining a reduction in the per-pound cost of production. This aspect will be considered during the siting and design stages for hatchery construction

ANADROMOUS FISH RUNS

Fall Chinook - To compensate for the loss of spawning grounds for an estimated 5,000 fish, and a 48-percent loss to juvenile downstream migrants passing through the turbines of the four lower Snake dams and other unquantifiable losses due to the Lower Snake River Project, it is proposed that propagation facilities be constructed to accommodate approximately 2,290 female adult fish and a like number of males, 11,450,000 eggs and 9,160,000 juveniles, totalling 101,800 pounds at release time, which is estimated to return 18,300 adults. A hatchery of this capacity would require approximately 40 acres of land and is estimated to cost \$6,200,000 for construction and \$450,000 annually for operation and maintenance. These costs include any necessary trapping and holding facilities. Since this race of fish normally spawned in the lower Snake River and in smaller streams tributary to it, this hatchery should be constructed as near to the Project area as possible, but downstream from the Project to minimize mortalities caused in passage through the four-dam complex. Although fall Chinook runs in the lower Columbia River are in relatively good condition and do not appear to be in danger of being completely lost, the particular run endemic to the lower Snake River area has suffered a serious and gradual reduction in recent years.

An economic analysis has been prepared on a 100-year project life as a basis for benefit-cost comparison.

<u>Item</u>	<u>100-Year Life</u>
<u>Initial Construction Cost</u>	\$6,200,000
<u>Annual Costs</u>	
Interest and Amortization, 5-7/8 percent	\$ 365,495
Operation and Maintenance	450,000
Total	<u>\$ 815,459</u>
<u>Annual Benefits</u>	
Commercial Fishery Value	
934,000 lbs. @ \$0.99 per lb.	\$ 924,660
Sport Fishery Value	
91,500 angler days @ \$9.00 per day	823,500
Total	<u>\$1,748,160</u>
<u>Benefit-Cost Ratio</u>	2.14:1

The proposed fall Chinook propagation facilities appear to be well justified.

Spring and Summer Chinook - Spring and summer Chinook spawn in the major tributaries of the Snake River, primarily the Salmon River. To compensate for a 48-percent loss to the spring and summer Chinook juvenile downstream migrants passing through the turbines of the four lower Snake dams and other unquantifiable losses due to the Lower Snake River Project, it is proposed that propagation facilities be constructed to accommodate approximately 2,145 female adult fish and a like number of males, 9,650,000 eggs and 6,750,000 juveniles totalling 450,000 pounds at release time which is estimated to return 58,700 adults above the Project area. Land requirements would be approximately 80 acres, and costs are estimated at \$11,500,000 for construction and \$900,000 for annual operation and maintenance. These facilities would include any trapping and holding facilities required. These propagation facilities will be constructed as multiple units and will be located upstream of the Lower Snake River Project to provide for the sport fisheries in eastern Oregon, Washington, and Idaho as well as downriver commercial fisheries. Of all the Lower Snake River Project propagation facilities, these would have the highest priority for an early start on the basis

that the summer Chinook are not maintaining their numbers now, even though there is virtually no fishery on these stocks. Were it not for the Rapid River hatchery of Idaho Power Company providing approximately one-third of the Snake River spring Chinook escapement in recent years, those stocks would be in similar trouble.

Because of the extremely low run of summer Chinook in 1974, a two-year emergency program was approved and funded by the Corps of Engineers to preserve a nucleus of this race of fish until adequate compensation features can be constructed. This program allowed for 400 female and 200 male summer Chinook to be trapped by Idaho Fish and Game Department and their progeny to be reared in Department hatcheries. Continuation of the program will depend upon its success in producing a sufficient number of juvenile migrants, the size of the runs in the ensuing years, and a rapid approval of this compensation plan.

An economic analysis has been prepared on a 100-year project life as a basis for benefit-cost comparison.

<u>Item</u>	<u>100-Year Life</u>
<u>Initial Construction Cost</u>	\$11,500,000
<u>Annual Costs</u>	
Interest and Amortization, 5-7/8 percent	\$ 677,867
Operation and Maintenance	900,000
Total	<u>\$ 1,577,867</u>
<u>Annual Benefits</u>	
Commercial Fishery Value	
2,994,000 lbs. @ \$0.99 per lb.	\$ 2,964,060
Sport Fishery Value	
293,000 angler days @ \$9.00 per day	<u>2,637,000</u>
Total	<u>\$ 5,601,060</u>
<u>Benefit-Cost Ratio</u>	3.55:1

The proposed spring and summer Chinook propagation facilities appear to be well justified.

Steelhead Trout - Steelhead trout also utilize the Project area as a migratory route to the upper Snake River and tributaries to spawn. To compensate for a 48-percent loss to the steelhead juvenile downstream migrants passing through the turbines of the four lower Snake River dams and other unquantifiable losses due to the Lower Snake River Project, it is proposed that propagation facilities be constructed to accommodate approximately 3,390 female adult fish and a like number of males, 16,950,000 eggs and 11,020,000 juveniles totalling 1,377,500 pounds at release time, estimated to return 55,100 adults above the Project area.

Land requirements would be approximately 80 acres. Construction cost is estimated at \$20,500,000 with annual operation and maintenance costs of \$1,500,000 and would include any necessary trapping and holding facilities. These facilities should be constructed upstream of the Lower Snake River Project to provide for the sport fisheries of eastern Oregon, Washington, and Idaho as well as the downriver fisheries.

The greater portion of monetary benefits from construction of the steelhead propagation facilities is derived from the sport fishery value of the fish produced. In order to provide full compensation of losses to the sport fishery, acquisition of streambank access, as discussed in the following section, is an integral part of the compensation plan. Since both are necessary and dependent upon each other, an economic analysis of the total steelhead compensation plan appears in the Anadromous Sport Fishery section.

ANADROMOUS SPORT FISHERY

A substantial stream-type sport fishery for anadromous fish, particularly steelhead trout, was developing in the Project area prior to and during project construction. With completion of Lower Granite Dam approximately 150 miles of stream-type area once available to the fishery will be essentially eliminated. All available data to date indicate that the catch per unit of effort is extremely low in a reservoir when compared with a stream. A fishery will exist in the tailrace

area of each dam, but this will not compensate for the total area which was lost. It has been estimated that the sport fishery for steelhead would have developed to an average of 130,000 angler-days annually during project life without the Project. To compensate for this loss of stream-type fishing it is proposed that 750 acres of land in small parcels be acquired either in fee title or some lesser estate at strategic points along streams in the lower and middle Snake River area which are known to have a high steelhead fishery use to provide assured access to these streams. Consideration will be given also to acquisition of areas on the main stem of the Snake River. All acquisition would be from willing sellers only; no lands would be condemned. Depending on location, development of these areas would include parking areas, trash cans, and primitive toilet facilities. The Corps of Engineers estimate for acquisition is \$750,000 based on the total acquisition approximating 750 acres, with an initial development cost of \$300,000 and annual operation and maintenance costs of \$10,000.

In the interest of acquisition of these lands, compatible with an efficient fishery management program, an agreement should be reached with the Washington State Game Department and Idaho Department of Fish and Game whereby these funds would be furnished to the Departments for acquisition of lands as they were available within a 10-year period after authorization of the Compensation Plan. Consideration should be given to first acquiring lands near the affected Project area to the fullest extent possible and then to lands not adjacent to the Project area compatible to a statewide fishery management program. Fair cost of these lands would be determined by independent appraisal. Apportionment of the acquisition would be 700 acres by the Washington Department of Game and 50 acres by the Idaho Department of Fish and Game. As these lands are acquired, initial development funds would be provided to the procuring agency by the Corps of Engineers. Title to these lands would be vested with the Departments of the states in which they are located who would then assume the responsibility for performing the operation and maintenance and budgeting the necessary funds for that purpose.

An economic analysis of the steelhead propagation facilities and streambank acquisition has been prepared on a 100-year project life as a basis for benefit-cost comparison.

<u>Item</u>	<u>100-Year Life</u>
<u>Initial Cost</u>	
Steelhead Hatchery	\$20,500,000
Fisherman Access Lands and Development	<u>1,050,000</u>
Total	\$21,550,000
<u>Annual Costs</u>	
Interest and Amortization, 5-7/8 percent	\$ 1,270,265
Operation and Maintenance	<u>1,510,000</u>
Total	\$ 2,780,265
<u>Annual Benefits</u>	
Commercial Fishery Value	
332,000 lbs @ \$0.55 per pound	\$ 182,600
Sport Fishery Value	
Outside Project Area - 236,000 angler-days @ \$9.00 per day	\$ 2,124,000
Acquired Access lands - 130,000 angler-days @ \$9.00 per day	<u>\$ 1,170,000</u>
Total	\$ 3,476,600
<u>Benefit-Cost Ratio</u>	1.25:1

It appears that the steelhead trout compensation proposal is well justified.

RESIDENT SPORT FISHERY

Prior to Project construction, a high quality stream fishery existed in the Project area for bass, sturgeon, and channel catfish and for rainbow and brown trout, Dolly Varden, bullheads, whitefish, crappie, and bluegills. With the impoundments, this fishery has been adversely affected. Fluctuations of the reservoir levels have reduced the spawning and rearing success of bass and other warm-water species. Sturgeon production is adversely affected. A popular fishery for bass and other warm-water species has developed in recent years and will continue to increase with the Project as more people are attracted to water-oriented sports, even though fishing success is expected to decline.

According to evaluation studies conducted by the fishery agencies on the resident fishery in the Project area, it has been estimated that

the average man-day use during project life would have been 250,000 stream fishing angler-days without the Project. With the Project, with the fishery restricted primarily to warm-water species, this use is expected to be 205,000 reservoir angler-days, a loss of 45,000 reservoir angler-days, or 67,500 stream angler-days. The fishery agencies state that this loss could be offset by supplemental stocking of 93,000 pounds of catchable-size rainbow trout annually in streams in the area, such as Asotin Creek, Grande Ronde, Tucannon, Touchet, Walla Walla, and Clearwater Rivers.

It is believed, however, that since this loss was incurred primarily on warm-water species in the Project area, every practical effort should be made to replace that loss in the affected area before providing a substitute fishery off-project. Means to accomplish this replacement which should be investigated would include the improvement of spawning and rearing habitat for warm-water species, development of subimpoundments for warm-water fish or trout and rehabilitation of tributary streams. To compensate for the loss to the resident fishery it is proposed that the Corps of Engineers be authorized to expend funds equal to the cost of design, construction, and operation and maintenance of a trout hatchery capable of producing 93,000 pounds of rainbow trout annually. The cost of such a hatchery is estimated at \$3,000,000 for construction and \$100,000 for annual operation and maintenance. Land requirements would be approximately 10 acres. The determination of the method of replacing the lost fishery will be based on more detailed future studies conducted by the Corps of Engineers with the assistance of Washington Department of Game. Construction and initial development of the hatchery or alternate measures would be funded by the Corps of Engineers.

An economic analysis for the trout hatchery has been prepared on a 100-year project life as a basis for benefit-cost comparison.

<u>Item</u>	<u>100-Year Life</u>
<u>Initial Construction Cost</u>	\$3,000,000
<u>Annual Costs</u>	
Interest and Amortization, 5-7/8 percent	\$ 165,800
Operation and Maintenance	<u>100,000</u>
Total	\$ 265,800
<u>Annual Benefits</u>	
Sport Fishery Value	
67,500 angler days @ \$9.00 per day	\$ 607,500
<u>Benefit-Cost Ratio</u>	2.29:1

The proposed sport fishery program appears justified.

The recreation-day values of \$9.00 per angler-day for sport fishing used in computing the foregoing benefit-cost ratio are based on the Water Resource Council's "Establishment of Principles and Standards for Planning," dated September 1973. The National Marine Fisheries Service has prepared a processed report entitled "Partial Net Economic Values for Salmon and Steelhead for the Columbia River System", by Merritt E. Tuttle, et al., January 1975, which provides justification for use of a value of \$28.00 per angler-day for anadromous fish in the Columbia River system. These data were developed on the basis of "Economic Evaluation of the 1967 Sport Salmon Fisheries of Washington," by Matthews and Brown, consistent with techniques described in "Principles and Standards". If this \$28.00 per day value were used, then the Benefit-Cost ratios for the anadromous fish hatcheries would be: 4.28:1 for fall Chinook, 7.1:1 for spring and summer Chinook, and 3.77:1 for steelhead.

The separate features of the fishery plan of development and their associated costs are summarized in Table 9.

A summary of the cost analyses for both fishery and wildlife features is shown in Table 15. All costs and benefits are based on 1974 prices.

It must be understood that these economic analyses are not normal project benefit-cost studies. The compensation actions recommended herein are required to replace project-caused losses and return the resource to a level which existed prior to project construction and therefore are not benefits to the total project. The benefit-cost ratios discussed here only evaluate the efficiency of moneys recommended for these compensation actions in relation to the value of the resource which is to be replaced.

ALLOCATION OF COSTS

The compensation measures described are for the four Lower Snake River projects as they now exist with three power units installed. These projects are very nearly the same height and have similar basic operating features. The pools vary somewhat in length, shoreline, and total capacity. Because of the similarity of the individual projects and because they were authorized as a single project, it is appropriate to allocate the costs equally among the four existing projects.

In allocating the costs between the navigation and power purposes, it has been determined that the loss of anadromous fish is caused primarily by the power turbines. This would make the compensation cost for hatcheries to replace the anadromous fish a separable power cost. Losses to resident fishery and stream-type anadromous sport fishery would apply to a power or navigation project and, therefore, the costs would be joint-use.

The cost allocation for Ice Harbor is final and has been approved by the Federal Power Commission. Cost allocations for the other projects are tentative and are subject to revision before final approval is obtained. The distribution of costs using these allocations is shown on the following page.

LOWER SNAKE RIVER FISH COMPENSATION
ALLOCATION OF COSTS

	Project Construction Cost <hr/> (\$1,000)	Annual Operation & Maint. <hr/> (\$1,000)
<u>Ice Harbor Dam</u>		
Joint Use - (Navigation	308	12
(Power	1,130	43
Specific - Power	<u>9,125</u>	<u>683</u>
Subtotal	10,563	738
<u>Lower Monumental Dam</u>		
Joint Use - (Navigation	208	7
(Power	1,229	48
Specific - Power	<u>9,125</u>	<u>682</u>
Subtotal	10,562	737
<u>Little Goose Dam</u>		
Joint Use - (Navigation	374	11
(Power	1,064	44
Specific - Power	<u>9,125</u>	<u>683</u>
Subtotal	10,563	738
<u>Lower Granite Dam</u>		
Joint Use - (Navigation	43	2
(Power	1,394	53
Specific - Power	<u>9,125</u>	<u>682</u>
Subtotal	10,562	737
GRAND TOTAL	42,250	2,950

TABLE 9

SUMMARY OF FACILITIES AND COSTS OF FISHERY COMPENSATION FACILITIES
LOWER SNAKE RIVER PROJECT

<u>Facility</u>	<u>Land Requirement</u>	<u>Cost</u>	
		<u>Construction</u>	<u>Annual O&M</u>
Fall Chinook Hatchery			
101,800 pounds smolt production	40 acres	\$ 6,200,000	\$ 450,000
Spring and Summer Chinook Hatcheries			
450,000 pounds smolt production	80 acres	\$11,500,000	\$ 900,000
Steelhead Trout Hatcheries			
1,377,500 pounds smolt production	80 acres	\$20,500,000	\$ 1,500,000
Rainbow Trout Hatchery			
93,000 pound capacity	10 acres	\$ 3,000,000	\$ 100,000
Streambank Lands for Fisherman Access and Development	750 acres	\$ 1,050,000	\$ 10,000 ^{1/}
TOTAL FEDERAL COST	960 acres	\$42,250,000	\$ 2,950,000

NOTE: a. Hatchery costs are based on actual recent experience at Dworshak, Spring Creek and Bonneville Hatcheries.

b. Land costs are based on knowledge of local land costs achieved by recent experience.

c. Hatchery costs include necessary trapping facilities.

d. Hatchery costs include necessary land @ \$1,000 per acre.

^{1/} Performance of and budgeting for operation and maintenance will be a state responsibility.

PROJECT IMPACTS ON WILDLIFE

PRE-PROJECT CONDITIONS

The Snake River Canyon within the area of influence of the Ice Harbor, Lower Monumental, Little Goose, and Lower Granite Dams varies from 100 feet in depth near its confluence to 2,000 feet near Lewiston, Idaho. The canyon is bounded by terraced bluffs, and the canyon walls consist of basalt outcroppings interspersed with steep, sparsely-soiled slopes and draws. The canyon floor is formed by basalt outcroppings, gravel flats, bars, and islands. Upland soils are of loessal origin while bottom-land soils are of alluvial origin, primarily silt and sand in content.

The rich alluvial soils of the bottom lands supported a variety of trees, shrubs, grasses, forbs, and cultivated crops which provided essential food and cover for wildlife. Willow, alders, hackberries, and an understory of teasel, poison oak, sumac, wild rose, cocklebur, wheatgrass, and wild rye comprised the natural streambank cover. Drier areas supported sagebrush and rabbitbrush interspersed with grasses. Other plants included Russian thistle, lupine, Jim Hill mustard, downy chess, and sanddock. Crops on agricultural lands consisted primarily of grain, forage, and orchards. A summary of river acreage, inundated acreage, acreage of high brush and trees under pre-project conditions, and project land acreage above the reservoirs is shown in Table 10. Data furnished by Washington Department of Game on estimated populations of principal wildlife species before project construction are shown in Table 11.

Big Game. Moderate numbers of mule and white-tailed deer inhabited the canyon slopes and bottom lands. Migrant deer from bordering uplands used the canyon during the hunting season and severe winters, and depended on the streamside vegetation and brushy draws for food and cover. The pre-project area contributed to the support of many deer that made an important contribution to the hunting harvest in surrounding areas.

TABLE 10

SUMMARY OF ACREAGES AVAILABLE FOR WILDLIFE
UNDER PRE-PROJECT AND POST-PROJECT CONDITIONS

<u>Project Units</u>	<u>River 1/ Acreage</u>	<u>Inundated Acreage</u>	<u>Pre-Project 2/ Vegetated Acreage</u>	<u>Approximate 3/ Project Land Acreage Above Reservoir</u>
Ice Harbor	5,122	3,253	356	4,864
Lower Monumental	3,517	3,073	92	8,397
Little Goose	5,185	4,840	155	6,790
Lower Granite	<u>5,640</u>	<u>3,260</u>	<u>520</u>	<u>5,440</u>
TOTAL	19,464	14,426	1,123	25,491

1/ Area occupied by river prior to project construction.

2/ Consists of high brush, trees, and orchards in narrow shoreline strips. Scaled from aerial photos made prior to clearing. All other lands inundated were grasslands with some sage-brush and rocky areas.

3/ Available for revegetation where soil and topography permit, except for those areas in use as industrial or recreation areas. Includes lands for relocation of railway and roads.

TABLE 11

ESTIMATED POPULATIONS OF PRINCIPAL GAME SPECIES IN WASHINGTON BEFORE
INUNDATION OF APPROXIMATELY 140 MILES OF LOWER SNAKE RIVER BY
HYDROPOWER DEVELOPMENT (1)

<u>Species</u>	<u>Base No. Before Inundation (2)</u>
Big Game	
Deer	1,800
Upland Game	
Pheasant	22,000
Quail	56,900
Huns	19,800
Chukar	52,100
Doves	120,200
Cottontail	<u>8,400</u>
Subtotal	279,400
Waterfowl (3)	
Ducks	17,500
Geese	<u>2,200</u>
Subtotal	19,700
Fur Animals	
Beaver	1,100
Muskrat	26,900
Mink	2,300
Otter	200
Raccoon	<u>2,600</u>
Subtotal	33,100
Game Units	
Total	334,000

- (1) Ice Harbor, Lower Monumental, Little Goose, Lower Granite Projects.
- (2) Determined from special survey of 1964-65-66 Harvest in Project Areas, Numbers rounded.
- (3) Reflects Hunting Season Population only - Does not indicate production changes. Actual Pre-project production in the project area approximated 600 goslings from a resident population of 400 geese.

TABLE 11

Surveys conducted by the Washington Department of Game indicate that approximately 1,800 deer were dependent upon habitat within the reservoir areas prior to inundation. These animals would have supported an estimated 12,600 hunter-days annually and a harvest of about 400 deer annually throughout the 100-year project life without the project.

Upland Game. Brush and trees interspersed with agricultural lands along the flood plain provided excellent living conditions for California quail, ring-necked pheasant, and cottontail rabbit populations. Chukar partridge occurred in abundance along numerous side draws and talus slopes adjacent to the project-affected river reaches, and gray or Hungarian partridge occurred locally where the upper slopes border agricultural lands.

The area influenced by the project supported high quality hunting based on liberal hunting seasons, a diversity of upland game, and good access along many reaches. Hunters were attracted to the area from considerable distances for these reasons. According to the survey data, it is estimated that approximately 279,400 upland game birds and animals were dependent upon habitat within the influence of the project areas. These birds and animals would have supported about 43,900 hunter-days annually with a harvest of about 27,400 animals annually within the project-affected area during project life without the project.

Fur Animals. Beavers, muskrats, mink, raccoons, skunks, weasels, bobcats, river otters, badgers, and coyotes were found along the river and adjacent slopes with beaver, muskrat, and mink being the principal species of economic importance. Fur harvests fluctuated according to market demands and recent low demand for most furs resulted in pelt harvests many times lower than fur animal populations would support. The data indicate that approximately 33,100 fur animals inhabited the project area with estimates that an average annual harvest of 4,200 pelts would be taken from the affected river area without the project.

Migratory Game Birds. Mourning doves and waterfowl used the canyon seasonally and as resident species. Doves nested, rested, and fed extensively along the canyon walls, side draws, islands, and bars during the summer months, finding food in abundance on adjacent agricultural lands and water readily available in the river and its tributaries.

Thousands of ducks and geese wintered annually on embayments, shorelands, and islands along the lower Snake River, and were dependent on local and adjacent agricultural lands for winter food. Island habitat was of particular importance for resting by waterfowl in general and for resting and nesting by geese. Although a few ducks nested in the area, an estimated 400 Canada geese reared 600 goslings annually in the project area.

Restrictions prohibited waterfowl hunting on or near the river for 84 miles of the Snake River and 3 miles of the lower Clearwater River, but hunting in adjoining counties was largely dependent on duck and goose populations that would winter on the river and fly out to feed on nearby croplands. The average annual hunter use of waterfowl based on goose production on project-affected areas is estimated to be 1,100 hunter-days without the project.

Nongame Wildlife. Mild temperatures and vegetative cover along the river encouraged many migratory and resident nongame wildlife species to the area year round. Nature enthusiasts and academic interests enjoyed the variety of birds and other nongame wildlife in the area.

Appreciative Use. Based on 17 years of data, the Washington Department of Game estimates that the present appreciative use (man-days spent in bird watching, studying, and just seeing wild animals) of wildlife species approximately equals man-days of hunting and is increasing at the rate of 4.14 man-days per year in proportion to the consumptive, or

hunting, use. A monetary value of \$1.00 per day has been used by the Department in evaluating this appreciative use.

PRESENT PROJECT CONDITIONS

Reservoirs resulting from the construction of Ice Harbor, Lower Monumental, Little Goose, and Lower Granite Dams will result in the inundation of 140.2 miles of riparian habitat varying from about 100 feet above the natural river level at each dam to approximately zero feet at the head of each reservoir. With the completion of Lower Granite Dam, the impoundments will have a total reservoir area of 33,890 acres, of which approximately 19,500 acres have always been occupied by the Snake River and 14,400 additional acres will be inundated which were occupied by bottom lands and canyon walls. These impoundments result in the loss of 48 islands five acres or larger in size, and 34 embayments five acres or larger in size. Only two islands of considerable size will be formed. Six of the embayments result from flooding of bottom lands at the Palouse River, Tucannon River, Alkali Flat, Deadman Creek, Penawawa Creek, and Alpowa Creek. Virtually all brushy shoreline, agricultural bottom land, and river island habitat has been lost resulting in a serious reduction in wildlife populations and wildlife-oriented recreation. Some higher side drainages with brush, trees, and shrubs remain unaffected above the lake levels, notably upstream from Central Ferry in the Little Goose-Lower Granite portion of the canyon. Railroad and roadway relocations have resulted in riprap embankments replacing much of the shoreline and creating hazards in gaining access to the water, particularly for larger forms of wildlife. Such bank protection measures also preclude re-establishment of vegetation that is vital to the survival of wildlife. Table 12 summarizes the impacts of the project on wildlife as estimated by the fish and wildlife agencies.

Table 12. Average Annual Wildlife User-Days, Lower Snake River Project, Washington State

Group	Without Project (Man-Days)	With Project (Man-Days)	Difference
Hunting Use <u>1/</u> (Big game, upland game, waterfowl)	57,600	18,200	- 39,400
Appreciative Use <u>2/</u> (Game and nongame species)	63,600	20,100	- 43,500
Fur Animals	4,200 (pelts)	2,100 (pelts)	- 2,100 (pelts)

Big Game. Loss of shoreline vegetation and agricultural bottom lands, as well as the flooding of the lower brushy draws, has reduced deer production in the Snake River canyon and adversely affected the capacity of the canyon to harbor deer from upland areas during severe winters. Riprap embankments and the roads and railroads present hazards for big game in gaining access to the waterline and are sterile insofar as their ability to produce vital riparian cover and food plants. The fish and wildlife agencies estimate that, due to project construction, big game populations will be drastically reduced and approximately 9,900 hunter-days for big game will be lost annually if compensation is not provided.

Upland Game. Upland game populations have been severely reduced as a result of the loss of native streamside vegetation, islands, and agricultural bottom lands. The fish and wildlife agencies estimate that this loss of essential riparian habitat has incurred a loss of about 120,800 small game birds and animals with a resultant reduction of 28,500 man-days of hunting annually without compensation.

1/ From BSWF-NMFS Report - Appendix A.

2/ From Washington Department of Game, 1974 Use figure. Appreciative use increasing at average rate of 4.14 man-days per year in proportion to hunting use in State of Washington.

Fur Animals. Beavers, muskrats, mink, raccoons, weasels, and river otters have suffered from the loss of streamside vegetation and the change from a free-flowing river to a reservoir situation. Skunks, bobcats, badgers, and coyotes have been adversely affected by loss of habitat and, also, by resultant reductions to upland game and nongame birds and animals which comprise their main food source. The fish and wildlife agencies estimate that the average annual fur animal harvest will be reduced by about 2,100 pelts annually and the population will be reduced by approximately 13,400 animals.

Migratory Game Birds. Doves have suffered from reduction of nesting and rearing areas and loss of agricultural bottom land food sources, but the effect has not been as severe as with other bird species. Waterfowl have been affected by the loss of 48 islands ranging in size from 5 to 150 acres and totalling nearly 1,500 acres in resting and nesting area. The loss of resting area from the flooding of these islands and 34 embayments, five or more acres in size, has been partially compensated by the formation of 92 embayments, five or more acres in size. Seven project-formed islands totalling 275 acres will not contribute significantly toward making up the loss of 48 potential goose nesting islands. Additionally, the loss of streamside forage and rearing areas on islands, bars, and agricultural bottom lands has significantly reduced goose production. Although little loss of waterfowl hunting will be realized due to the preponderance of winter migrants, the fish and wildlife agencies estimate that there will be an average loss of 1,000 man-days annually based on the loss of local goose production.

FISH AND WILDLIFE AGENCIES' RECOMMENDED
COMPENSATION MEASURES FOR
WILDLIFE LOSSES

To achieve compensation for Lower Snake River Project-caused losses of wildlife delineated in the preceding section of this report, the fish and wildlife agencies have recommended the following studies and measures in their report (Appendix A).

1. a. A three-year study designed to formulate a habitat development plan for big game, fur animals, and nongame wildlife on project lands. The study would be conducted cooperatively by Bureau of Sport Fisheries and Wildlife, Washington Department of Game, and Corps of Engineers. Estimated cost - \$60,000.

b. Estimated project funds in the amount of \$2,370,000 be made available to Washington Department of Game and Bureau of Sport Fisheries and Wildlife for development of wildlife habitat on project lands. Fund disbursement would be made on the basis of study findings outlined in the above recommendation. The annual operation, maintenance, and replacement of waterfowl habitat (OM&R) costs are estimated at \$40,000 for the initial five-year period. Following this period, the OM&R costs would be assumed by the projects as a function of their normal operation and in conjunction with other park and recreational plantings.

2. a. A five-year study designed to formulate a waterfowl habitat development plan on projects' area. The study would be conducted cooperatively by Washington Department of Game and Washington State University in consultation with Bureau of Sport Fisheries and Wildlife and Corps of Engineers. Estimated cost - \$100,000.

b. Estimated project funds in the amount of \$201,250 be made available to Washington Department of Game and Bureau of Sport Fisheries and Wildlife for development, operation, maintenance, and replacement of waterfowl habitat on projects' lands and waters. These funds would be allocated on the basis of the study findings outlined in the above recommendation. Estimated annual operation, maintenance, and replacement costs would be \$5,000.

3. a. A two-year study designed to upgrade habitat for upland game birds on lands in the vicinity of the projects. Suitable sites would be located and watering devices and water control structures would

be constructed and evaluated to determine their effectiveness in offsetting project-incurred losses. Washington Department of Game and Bureau of Sport Fisheries and Wildlife would jointly conduct the study. Estimated cost - \$40,000.

b. Estimated project funds in the amount of \$16,250 be made available for installation of about 65 watering facilities to be located on lands adjoining the projects as determined by the study outlined in the above recommendation. Annual OM&R would be project costs estimated at \$500. Washington Department of Game would be responsible for OM&R through the transfer of project funds from Corps of Engineers.

c. Estimated project funds in the amount of \$120,000 be made available for acquiring perpetual public access easements on 32,000 acres of rangeland surrounding the installed watering devices as determined by the above study recommendation pertaining to this item. Corps of Engineers in cooperation with Washington Department of Game and Bureau of Sport Fisheries and Wildlife would obtain the necessary easements.

4. An upland game management program be undertaken with project funds to offset project-incurred upland game losses. The program would include land acquisition of about 660 acres costing \$328,500. About 14,250 acres of land surrounding the land parcels acquired in fee would be placed in perpetual easement status under landowner agreements at an estimated cost of \$1,069,000. Habitat development costs for all management lands are estimated at \$146,200 with annual operation, maintenance, and replacement amounting to about \$5,350. Washington Department of Game would be responsible for initiating and managing this program with project funds.

5. A game bird farm be constructed (or suitable alternate provided) in the projects' vicinity and managed for stocking the wildlife management units proposed in the above recommendation. This facility would

have an estimated capital cost of \$1,000,000 and annual operation, maintenance, and replacement costs estimated at \$68,000. These costs designed to mitigate project-incurred losses are considered to be a project responsibility. Washington Department of Game would assume management responsibility.

6. Destruction of vegetation on project lands be held to a minimum. Plans for vegetation retention be cooperatively developed by Corps of Engineers, Washington Department of Game, Idaho Fish and Game Department, and Bureau of Sport Fisheries and Wildlife.

7. Corps of Engineers' placement of spoil and programs using herbicides and pesticides on project lands or waters be evaluated in cooperation with Environmental Protection Agency, Bureau of Sport Fisheries and Wildlife, National Marine Fisheries Service, Washington Departments of Fisheries and Game, and Idaho Fish and Game Department.

8. In accordance with the February 12, 1972, Joint Policy of the Departments of the Interior and the Army, relative to reservoir project lands and waters, all project lands and waters that are of value for fish and wildlife management as may be mutually determined by Corps of Engineers, Bureau of Sport Fisheries and Wildlife, and Washington Department of Game, should be made available to Washington Department of Game under terms of a general plan and subsequent cooperative agreement.

9. A zoning plan be developed to assure equitable use of the reservoir and adjacent lands for fishing and hunting as well as other recreational purposes. Such a plan should be developed by Corps of Engineers in cooperation with Bureau of Sport Fisheries and Wildlife, National Marine Fisheries Service, Bureau of Outdoor Recreation, Washington Department of Fisheries, Washington Department of Game, and Idaho Fish and Game Department.

10. Federal lands and project waters in the project areas be open to the public for hunting, fishing, and related recreation uses except for areas reserved for safety, efficient operation, or protection of public property, or those areas where closures may be found necessary by Washington Department of Fisheries, Washington Department of Game, National Marine Fisheries Service, and Bureau of Sport Fisheries and Wildlife to conserve and/or develop fish and wildlife resources.

11. Leases of Federal lands in the project areas assure the right of public use of such lands for hunting, fishing, and related activities.

12. Such reasonable modifications be made in the authorized projects' facilities and operations as may be agreed upon by Directors of the Bureau of Sport Fisheries and Wildlife, National Marine Fisheries Service, Washington Departments of Fisheries and Game, Idaho Fish and Game Department, and Chief of Engineers, for conservation, improvement, and development of fish and wildlife resources.

DISCUSSION

Shoreline vegetation, which provides vital food and cover for big game, upland game, waterfowl, fur bearers, and nongame wildlife, has been and will be removed or inundated nonselectively by the filling of the reservoirs behind the four lower Snake River dams. This riparian habitat existed as scattered, narrow strips along the river and in bushy canyons and draws interspersed with rocky outcroppings. The rest of the inundated lands consisted of rocky cliffs and rather steep hillsides covered mostly with sagebrush and dryland grasses. This unique combination of water, food, cover, forbs, and surrounding low elevation lands sustained a large variety and number of wildlife animals which provided considerable hunting recreation both in the project and the surrounding areas. This habitat provided an essential element at some particular stage of the life cycle of these animals.

Although all animals have specific requirements of space, food, and cover, different species may occupy the same area without competition because of different requirements. Wildlife will occupy all available space which provides these necessary requirements. Elimination of the habitat within the reservoir areas means that the animals which depended on this habitat will either be eliminated or crowded into adjacent lands. Since these adjacent lands will only support a given number of animals, and are probably already supporting the maximum number possible, the overall wildlife population will be reduced by nearly the total number of animals whose habitat was eliminated. To increase the carrying capacity of these adjacent lands, and retain total wildlife numbers at a pre-project level in the region, it is necessary to develop the habitat in other areas to accommodate a greater number and variety of animals than existed previously. Compensation of project-caused losses to wildlife requires that these displaced animals be replaced in numbers and kind or that these resources be replaced with an alternative satisfactory to the fish and wildlife agencies.

Prior to construction, the river shore supported about 1,123 acres of brush and tree-type vegetation backed by fertile bottom lands in many areas. Raising of the reservoirs has eliminated all of this riparian vegetation, except for some brushy draws, and replaced the fertile bottom lands with dry steep slopes, rocky cliffs, and riprapped embankments along much of the shoreline. Resident mule and white-tailed deer depended on the shoreline vegetation for food and cover throughout their life cycle. During hunting seasons and hard winters, migratory deer which summered in surrounding higher farmland areas also depended on this river-bottom land for food and cover during this critical time. Surveys conducted by the Washington Department of Game indicate that approximately 1,800 deer were dependent upon this shoreline habitat annually. Destruction of this habitat eliminates critical winter range and forces the animals to winter in higher, open lands which cannot support that many head under present condition. Consequently, these

animals will die or overuse the range, depleting it badly, thereby reducing its carrying capacity below what it was normally. This means that those deer dependent on the streamside vegetation for existence would be eliminated from the total population.

Upland game birds and small game animals have varied requirements for food, cover, and water, but the riparian vegetation strips fulfill vital needs for each of them in their life cycle. Because of their dependence on this area, it becomes a limiting factor in determining the numbers of the various species populating the surrounding area. In early spring the birds will be widely scattered for nesting and hatching of young because the spring growth of vegetation provides adequate food and cover for this purpose, and spring rains provide water holes and small streams over a wide area. The diet of newly hatched birds requires a high protein content which is furnished mainly by insects. As the vegetation in higher areas dries up and water supplies disappear in the summer, the birds move down to the shoreline to rear their young. As the birds mature, their diets convert to seeds and sprouting grasses in the fall. This diet change and hunting pressure scatters the birds throughout the surrounding areas. With winter weather, the birds congregate in the lower shoreline vegetation again for food, cover, and water. As with the big game animals, the total numbers of small game animals are reduced considerably with elimination of the essential shoreline habitat. Of the estimated 279,400 small game birds and animals present under pre-project conditions, some 120,800 will be lost because of the project.

Fur animals are entirely dependent on a close vegetation-water relationship. Beaver and muskrat are vegetarians which live in the water. Mink, otter, and raccoon are predatory animals which live on fish, crayfish, and other small animals. This food source is abundant in the

riparian habitat. With elimination of this vegetation, the sources of food and cover are removed and the animals are displaced. According to survey estimates, 33,100 fur animals inhabited the area prior to construction. Without compensation, about 13,400 of these animals will be lost.

With regard to migratory game birds, some waterfowl reside in the area but are mostly transient visitors in the late fall, winter, and early spring. There was some nesting by ducks along the river shoreline and the islands were used by Canada geese for nesting sites. The young of both utilized the early spring grasses on the flat shoreline areas for grazing until they were big enough to migrate. The reduction in duck nesting is probably not serious, but almost all of the goose nesting islands have been inundated. Also, the fertile bottom lands used as grazing areas by the young birds have been replaced by steep hillsides with raising of the reservoirs. The larger water areas of the reservoirs will probably attract more waterfowl to the area for resting than occurred on the open river, but goose production in the area, estimated at some 600 birds annually, has been drastically reduced because of the inundation of some 40 potential goose nesting islands and adjacent grazing areas in the Project area.

For project purposes, some 25,000 acres of land surrounding the reservoirs have been purchased from private owners and placed under Federal ownership. Within these Project lands, certain areas have been set aside for port and recreation sites, and much of the shoreline has been used for relocation of roads and railroads. There is still considerable acreage within these lands which can be developed for wildlife habitat. In order to develop this habitat to the maximum potential with

the least delay, the Walla Walla District retained independent consultant services to provide them with a comprehensive habitat development plan. This plan is being submitted as a design memorandum for approval, funding, and immediate implementation under existing authority. In the development of this habitat plan for Project lands all aspects were considered such as land formation, soil types, vegetation, and relationship to adjacent land uses. The development plan recommends certain areas be intensively managed by planting shrubs, trees, and other food and cover crops. Irrigation will be required to maintain the habitat and certain areas will require fencing to prevent damage by cattle.

According to data furnished by the Washington Department of Game, present wildlife populations on Project lands are approximately 56 percent of the pre-project level. Planned habitat development on these lands is expected to increase these populations to about 70 to 80 percent of pre-project numbers (Table 13). The cost of implementing this development plan is estimated at \$2,600,000 for initial development and \$120,000 annual operation and maintenance.

While the Project areas hold the potential for some compensation, full compensation for Project-caused losses cannot be provided on these lands. Also, the time required to develop these lands to their fullest potential can be as much as 10 to 15 years. The agencies have therefore recommended acquisition of certain off-project lands of high wildlife value and development potential. These lands, along with development of Project lands, are essential for the purpose of providing compensation. Since full compensation for all species of wildlife lost through Project construction cannot be provided, the Washington Department of Game plans to stock pheasants on both project and off-project lands for hunter use as a substitute for those certain species which cannot be fully compensated as well as for lost hunter opportunity on Project lands.

The numbers in the fish and wildlife agencies' report pertaining to wildlife population estimates, hunter-day use, harvest levels, and

TABLE 13
WILDLIFE POPULATION ESTIMATES - LOWER SNAKE RIVER PROJECT

	Upland Game	Chukar	Doves	Deer	Total
Pre-Project <u>1/</u>	107,100	52,100	120,200	1,800	281,200
Post-Project <u>1/</u>	40,300	12,500	105,800	600	159,200
Recoverable <u>2/</u>	13,600	11,700	2,900	700	28,900
TOTAL (Post-Project and Recoverable) <u>3/</u>	53,900	24,200	108,700	1,300	188,100

- 1/ Data supplied by Washington Department of Game.
2/ Estimated increase from wildlife habitat development on project lands.
3/ Estimated total wildlife populations after development of habitat on project lands.

land amounts have been developed on the basis of field survey information. Use and harvest estimates were developed from base data obtained by Washington Department of Game through aerial flight observations, car counts, checking station information, questionnaires, and personal interviews. Projections of use and harvest for Project life were related to anticipated population growth in the region and available information on trends in proportions of population groups that hunt or otherwise use the wildlife resource. Animal population estimates were made in part by direct survey and by calculation from harvest figures and sample age class analysis techniques.

Land amounts are in general related to the amount of key habitat actually lost, the extent of adjacent lands and their capability to carry the wildlife populations and the amount of space needed to accommodate levels of human use of the resources based on experience at existing public hunting areas. In this plan an effort will also be made, insofar as possible, to replace riparian type habitat with the same type of critical and vital habitat.

It is recognized that the enumeration of wildlife populations, human use, harvest levels, and land needs for this plan are based on limited information. In this context, the qualifications used in the fish and wildlife agencies' report appear to be reasonable to establish the general extent of wildlife losses and compensation requirements created by the Lower Snake River Project and to use as a basis for authorization and further detailed planning.

ALTERNATIVES TO THE PROPOSED ACTION

The compensation plan presented in this report contains features which are considered to hold the greatest potential for restoring fish and wildlife losses caused by construction of the four lower Snake River dams. The recommended actions contained in the fish and wildlife agencies' report were selected by the seven agencies involved: U.S. Fish and Wildlife Service, National Marine Fisheries Service, Washington Department of Fisheries, Washington Department of Game, Fish Commission of Oregon,

Oregon Game Commission, and Idaho Department of Fish and Game, from a number of alternative actions based on their experience with these alternatives under various field and research conditions. During the preparation of that report, 1966 to 1972, a thorough analysis of these various means was made. The final actions recommended in this report are the result of considerable coordination between the Walla Walla District Corps of Engineers and the fish and wildlife agencies, results of later research, reports from independent consultants who reviewed the data, and comments from the general public.

Representative alternative actions considered in formulation of the final recommendations are:

No Action - This does not meet the requirements of the Fish and Wildlife Coordination Act, and losses caused by project construction would still remain.

Removal of Dams - This is not feasible because of the money already spent for construction and the relinquishment of benefits derived from the projects.

More Intensive Development of Wildlife Habitat on Project Land - This would reduce the amount of off-project land required for compensation of wildlife losses. The amount of developable land remaining along the shoreline has been severely reduced after project construction because of extensive reaches of riprapped railroad and highway relocations, and vertical barren cliffs. Those areas which can be developed are not capable of replacing the amount and kind of habitat and wildlife numbers existing along the open river. Present plans for development of habitat on project lands, as developed by independent consultants, demonstrate the maximum improvements obtainable which are economically feasible.

PLAN OF DEVELOPMENT

GENERAL:

Raising of the Project reservoirs has eliminated almost all of the riparian vegetation along the river bottom except for some brushy draws, and replaced the fertile bottom lands with dry steep slopes, rocky

cliffs, and riprapped embankments along much of the shoreline. For Project purposes, some 25,000 acres of land surrounding the reservoirs have been purchased from private owners and placed under Federal ownership.

Within these Project lands, certain areas have been set aside for port and recreation sites and much of the shoreline has been used for relocation of roads and railroads. There is still some acreage within these lands which can be developed for wildlife habitat.

Through a comprehensive plan developed by an independent consultant, maximum compensation possible will be accomplished on these lands. Implementation of this development will be accomplished as rapidly as possible, pending approval by the wildlife agencies. Because of the length of time required for plant growth and the difficulty of supplying water to them, full development of good vegetative cover will require a period of 10 to 15 years. Certain areas can be more suitably developed for certain wildlife game species while nongame birds and animals will benefit from all development. While the Project areas hold the potential for some compensation, it is believed that only 70 to 80 percent of pre-project wildlife populations can be supported on Project lands.

To minimize the delay in providing compensation, the acquisition of certain off-project lands is proposed on which immediate development and compensation can be accomplished. These lands would serve the purpose of providing compensation during the interim period until development of Project lands occurred and will be retained after Project lands are developed.

Pheasant stocking on these off-project lands for hunter use will be provided as an immediate replacement for upland game birds and animals affected by the Project and for certain other game and nongame species which cannot be compensated for.

The wildlife review report prepared by an independent consultant, Appendix D, recommends that immediate development of Project lands should be the first step in providing wildlife compensation. Because of the fact that it will take some years for the Project land habitat development to be fully productive and the fact that it will never provide full compensation, the report also recommends that acquisition of additional off-project lands is necessary if adequate compensation is to be realized.

DEVELOPMENT OF PROJECT LANDS

An independent report on wildlife habitat development on Project lands has been completed and is under review by the state and Federal wildlife agencies and the Corps of Engineers. After completion of this review and acceptance of the recommended plan, this report will be forwarded to higher authority for implementation and funding as a normal Project budgetary function. Development of habitat on Project lands is an important factor in providing partial compensation for wildlife losses caused by the Project. Authority already exists to conduct this development since these lands are under Federal ownership. Therefore, other than this discussion on the development and its relationship to the overall Project compensation plan, it will not be included in this recommendation for separate Congressional approval and funding.

The first step in development of Project lands was a comprehensive study to determine those areas to be developed primarily for wildlife excluding port and industrial sites, and those which have other designated uses but would be compatible with wildlife, such as recreation areas which would have some benefit on a seasonal basis. Soil types, availability of water, either ground or irrigation, and types of vegetation most suitable for wildlife production in these areas were determined. Revegetation will serve to replace some of the riparian habitat which existed under pre-project conditions and served as wintering and brood-rearing areas for upland game birds and other wildlife. Some degree of compensation for lost hunting will also be provided in the Project area.

Included in this plan is development of waterfowl habitat for implementation within the Project area. This plan is aimed toward developing goose nesting sites for replacement of islands inundated by the reservoirs. A prime requirement for successful goose nesting is the proximity of the nest to a grazing area for the young birds. Sites have been selected at which floating islands could be located or artificial nesting platforms could be constructed.

Based on the recommendations of this plan, it is proposed to proceed with an aggressive habitat development program on Project lands and waters, using funds obtained through normal Project appropriations means.

Initially, some types of vegetation will require irrigation to become established. Plantings would be selected and located to provide food and cover. Such shrubs as serviceberry, chokecherry, and hawthorn, a variety of trees and various grasses and forbs would be provided. Work of a structural nature such as construction of small islands, sub-impoundments in bays and inlets, fences, and artificial goose nests may also be required. Cost of development is estimated to be \$2,600,000 for habitat development on Project lands for big game, upland game birds and animals, fur animals, and nongame wildlife, with annual operation and maintenance cost of \$120,000. Actual development work and the operation and maintenance of on-project habitat compensation areas would be accomplished by the Corps of Engineers. The Washington Department of Game will be consulted on this development and will be requested to perform periodic evaluations beginning in the fifth year after development is begun to determine the effectiveness of habitat development. It is estimated that this evaluation would require five years and cost \$50,000. These costs have been included in the above cost estimate.

DEVELOPMENT OF OFF-PROJECT LANDS

Completion of the four dams in the Project area has caused considerable loss of wildlife in the area because of habitat destruction. Because of the length of time, 10 to 15 years, necessary to establish

new vegetation on Project lands and since full compensation cannot be obtained on Project lands, it is necessary to immediately provide means of compensation to prevent further losses. To do this will require acquisition of nearby off-project lands which can be developed with immediate results. Upland game birds and animals have been most affected by loss of habitat and will derive the most benefit. Big game and other animals would also benefit from habitat development for upland game birds.

As the method to compensate for losses to upland game bird habitat which cannot be compensated for on Project lands, it is proposed that off-project land be acquired in areas that would accomplish necessary compensation, be available from willing sellers, be in the general Project vicinity, and provide as much riparian type habitat as possible.

The Washington Department of Game has estimated that even with habitat development on Project lands, it would require 500 acres of existing riparian habitat and 10,000 acres of farmland surrounding the habitat to replace the lost upland game birds and hunter opportunity. To be effective, this riparian habitat which would furnish food, cover, and nesting areas, should be acquired in several parcels and should be acquired in fee. The lands would be fenced to prevent overgrazing by cattle. Water access for cattle would be permitted, however, to reduce the impact of the acquisition on the landowners. The surrounding farmlands would also provide some food and cover and be a dispersal area for the birds. Easements would be required on these lands to assure hunter access in order that they could more fully utilize the extensive compensation efforts. To provide hunter access to these lands, parking areas could be provided periodically along a public road with corridors from the parking areas to the easement lands. All land acquisitions, both in fee and easements, will be from willing sellers only.

Plans are underway, however, to develop wildlife habitat on Project lands. Since this development will require a period of 10 to 15 years

to become established, the Washington Department of Game requests that some of these off-project lands be acquired immediately to replace the game birds and hunter opportunity as quickly as possible to compensate for these losses. The Washington Department of Game estimates that immediate acquisition of 400 acres of existing riparian habitat, to be acquired for access, would permit them to stock a sufficient number of birds to replace the lost hunter-day use. As habitat is developed on Project lands, the stocking intensity on these acquired lands would decrease proportionate to the Project land development. These lands would still be retained, however, and stocked with birds as a substitution for certain nongame species for which full compensation is not economically feasible or possible.

The Washington Department of Game should be the agency designated to select and acquire the lands with funds provided by the Corps of Engineers. The Department would acquire within an approximate 10-year period from initial appropriation of funds the necessary lands using the willing-seller concept. Assurances under Sections 210 and 305 of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (Public Law 91-646; 84 Stat. 1894) will be required of the Department prior to entering into an agreement for acquisition. Performance under the acquisition agreement will be monitored by the Corps of Engineers.

It is recommended that authority be granted to acquire approximately 400 acres in fee and 8,000 acres in easement as an immediate step in compensating for pheasants and pheasant hunter-day losses. It is also recommended that authority be granted to enter into agreement with the Washington Department of Game under which the Department would conduct the acquisition and development. Estimated costs are \$2,100,000 which include estimated present-worth value of the land costs, administrative overhead, and initial development costs for fencing and parking areas. Land and initial development costs would be reimbursed to the Washington Department of Game. Operation and maintenance, and funding for that purpose, would be the responsibility of the Department.

In order to compensate for the effect of lost riparian habitat on chukar partridges, the wildlife agencies recommended that approximately 32,000 acres of land along the breaks of the Snake River adjacent to Project lands be acquired in easement for installation of watering devices and public hunting. These watering areas would extend the range and numbers of birds which the total area could accommodate.

Because of the extent of lands in the area already under Federal ownership, agreement was reached with the wildlife agencies that a portion of the 25,500 acres of Project lands suitable for chukar development could be credited against the 32,000 acres requested to reduce the amount of additional lands to be acquired and placed under partial Federal jurisdiction. This reduction would leave about 15,000 acres to be acquired in easement. These lands would be located in specific side draws which offer the best opportunity for development, in corridors extending from a public road to the Project lands. It may be desirable, also, to obtain additional lands adjacent to the mouth of selected draws which have high wildlife potential.

The Project lands are open to hunting except for designated safety areas and acquisition of easements on private land corridors would permit hunters to gain access to the Project lands at various locations. Parking areas would be provided at these various access points. It is proposed to acquire perpetual easements from willing sellers, during the hunting season only, on approximately 15,000 acres of off-project lands for assuring future public access for chukar partridge hunting at an estimated cost of \$263,000. This acquisition of easements would be conducted by the Corps of Engineers, within a 10-year period following initial appropriation of funds, and development, operation, and maintenance would be the responsibility of the Corps as an integral part of development on Project lands.

To expand game-bird range on all off-project lands indicated above where lack of water is the limiting factor, and thus compensate

for Project-caused losses, it is proposed to install watering devices and develop springs and natural drainages at strategic sites for use by upland game (principally chukars). Preliminary investigations indicate the need for installation of about 50 cisterns and development of a few springs and natural drainages. Protective fencing around these cisterns would be required, each of which would require approximately 0.1 acre of land. Landowner agreement would be required for installation of such devices and for access to accomplish maintenance of them. Capital costs for cistern installation, waterway development, and fencing are estimated at \$16,000. Estimated annual operation, maintenance, and replacement costs would be \$1,000.

To provide the birds for stocking, the agencies recommend construction of a game bird farm or enlarging an existing Washington Department of Game facility. The present facilities operated by the State of Washington do not have this capability. Approximately 20,000 birds annually are required. The facility for production of game birds for these lands was estimated by the wildlife agencies to cost \$1,000,000, with annual operation and maintenance costs of \$68,000, and to require approximately 25 acres of land.

The concept of stocking pheasants on the compensation lands is concurred with in the consultant's report, Appendix D; however, alternate suggestions were made to: purchase these birds from an approved source for a period of years after habitat development was begun until a natural brood stock could be built up; or to construct a bird farm in conjunction with other outdated units operated by the Department which would be phased out after a period of years as a brood stock became established.

A minimum period of stocking pheasants appears to be 20 years after authorization of the compensation plan. This would encompass the 10 years for land acquisition, 5 years for development of habitat, and 5 years to establish a natural brood stock. At an estimated present cost of \$5.00 per bird, the cost of stocking for the 20-year period would be \$2,000,000. The Department does not favor introducing a strain which would not be compatible with the native birds.

It is recommended that authority be granted to the Corps of Engineers to enter into an agreement with the Washington State Department of Game whereby the present worth value of \$2,000,000 which is \$1,159,000 at present Federal interest rate of 5-7/8 percent would be made available to the Department and the Department would supply 20,000 birds per year to fulfill the compensation requirements either by constructing a new game bird farm or enlarging an existing facility, or by outright purchase of birds.

Full compensation is defined as the maintenance of habitat and production of game animals which will sustain the hunting pressure, appreciative use which would have occurred if the Project had not been constructed, and the maintenance of nongame animals at pre-project levels. This hunting pressure and appreciative use have been estimated at 121,200 man-days annually. It is intended that the substantial comprehensive development of project and non-project lands described in this plan will provide full compensation for habitat, animals and related hunting pressure reduced by the Project.

Because the various increments of the wildlife plan are interdependent in achieving full compensation, including development of Project lands, they are evaluated for justification as a single unit and also appear in the summary economic analysis in Table 15. The analysis is based on a 100-year project life.

<u>Initial Cost, Lands and Development</u>	\$6,138,000
<u>Annual Costs</u>	
Interest and Amortization, 5-7/8 percent	\$ 361,804
Operation and Maintenance	121,000
Total Federal Cost	<u>\$ 482,804</u>

Annual Benefits

Big Game Hunting Value	
9,900 hunter-days at \$9.00 per day	\$ 89,100
Upland Game Hunting Value	
28,500 hunter-days at \$9.00 per day	256,500
Waterfowl Hunting Value	
1,000 hunter-days at \$9.00 per day	9,000
Appreciative Use	
43,500 user-days at \$2.25 per day	<u>97,895</u>
<u>Total Annual Benefits</u>	\$ 452,495
<u>Benefit-Cost-Ratio</u>	0.94:1

Tangible benefits, as evaluated above for the total compensation plan, will accrue from management of existing project lands and additional lands proposed in this report which are contiguous to the existing project lands. Wildlife production is interrelated and benefits will accrue proportionally to the investments in each component part of the total plan. Because of the intangible nature of the wildlife resource not subject to monetary evaluation, the benefit-to-cost ratio does not measure adequately the total value of the resource. Wildlife compensation plans are considered well justified based on both tangible and intangible benefits. All costs and benefits are based on 1974 prices.

The user-day values used in computing the foregoing benefit-cost ratio are based on the Water Resource Council's "Establishment of Principles and Standards for Planning", dated September 1973.

A summary of the estimated costs of proposed wildlife plan is included in Table 14.

Public meetings and subsequent input to the meeting records indicate both support and opposition. Environmental groups generally support the plan; some, in fact, saying the proposed plan is too conservative. Others, including farmers and landowners, are staunchly opposed to the off-project land acquisitions.

ALLOCATION OF COSTS

As proposed on page 52, because of similarity of the four Snake River projects and because they were authorized as a single project, it is appropriate to allocate the wildlife costs equally among the four projects and assign these costs to the existing project. Since wildlife losses are primarily created through inundation of lands, the costs would apply to both navigation and power. These costs would, therefore, be considered as joint-use costs, and distribution between navigation and power would be in accordance with the approved cost allocations.

The cost allocation for Ice Harbor project is final and has been approved by the Federal Power Commission. Cost allocations for the other projects are tentative and are subject to revision before final approval. The distribution of costs using these allocations is shown on the following page.

Estimated total first cost to the United States for implementation of the foregoing fish and wildlife compensation plan is approximately \$45,788,000. The total Federal cost for annual operation, maintenance, and replacement is estimated at approximately \$2,951,000. Federal funding for acquisition and initial development of habitat and fisherman and hunter access lands by the State would be subject to their agreement to fund any additional development and annual operation and maintenance costs. These costs should be applied against the original project. Capital costs should be amortized at the interest rate applicable to the original project. Based on present tentative cost allocations, \$1,507,000 of capital costs and \$32,000 of annual operation and maintenance costs would be allocated to navigation and \$44,281,000 of capital costs and \$2,919,000 of annual operation and maintenance costs to power. Power costs will be reimbursed from power revenues. This allocation is subject to change when final allocations are approved on Lower Monumental, Little Goose, and Lower Granite.

LOWER SNAKE RIVER WILDLIFE COMPENSATION
ALLOCATION OF COSTS

	Project Construction Cost <u>(\$1,000)</u>	Annual Operation & Maint. <u>(\$1,000)</u>
<u>Ice Harbor Dam</u>		
Joint Use - Navigation	189	0
Power	<u>696</u>	<u>0</u>
Subtotal	885	0
<u>Lower Monumental Dam</u>		
Joint Use - Navigation	128	0
Power	<u>756</u>	<u>0</u>
Subtotal	884	0
<u>Little Goose Dam</u>		
Joint Use - Navigation	230	0
Power	<u>655</u>	<u>0</u>
Subtotal	885	0
<u>Lower Granite Dam</u>		
Joint Use - Navigation	27	0
Power	<u>857</u>	<u>1</u>
Subtotal	884	1
GRAND TOTAL	3,538	1

TABLE 14

SUMMARY OF ITEMS AND COSTS OF WILDLIFE COMPENSATION FACILITIES

LOWER SNAKE RIVER PROJECT

<u>Item</u>	<u>Initial Cost</u>	<u>Annual O&M</u>
Off-Project Lands		
Riparian and Farm Lands		\$5,000 <u>1/</u>
Fee, 400 Acres	\$ 225,000	
Easement, 8,000 Acres	1,700,000	
Initial Development	175,000	
Range Land Canyons		
Easement	263,000	
Development	16,000	\$1,000
Game Bird Replacement	<u>1,159,000</u>	<u> </u>
Total Federal Cost	\$3,538,000	\$1,000

1/ Operation and maintenance of these lands and budgeting of necessary funds will be a State responsibility.

TABLE 15

SUMMARY ECONOMIC ANALYSIS
LOWER SNAKE RIVER FISH AND WILDLIFE COMPENSATION PLAN

	<u>Initial Cost</u>	<u>Annual Cost</u>	<u>Annual Benefits</u>	<u>B/C Ratio 1/</u>
<u>Fishery</u>				
Fall Chinook Facilities	\$ 6,200,000	\$ 815,459	\$ 1,748,160	2.14:1
Spring-Summer Chinook Facilities	11,500,000	1,577,867	5,601,060	3.55:1
Steelhead Facilities and Sport Fishery Access Lands	21,550,000	2,780,265	3,476,600	1.25:1
Resident Sport Fish Facilities	<u>3,000,000</u>	<u>265,800</u>	<u>607,500</u>	<u>2.29:1</u>
Total Fishery	\$42,250,000	\$ 5,439,391	\$11,433,320	2.11:1
<u>Wildlife</u>				
On-Project Features	\$ 2,600,000	\$ 273,257	\$ 256,112	0.94:1
Off-Project Features	<u>3,538,000</u>	<u>209,547</u>	<u>196,383</u>	<u>0.94:1</u>
Total Wildlife	\$ 6,138,000	\$ 482,804	\$ 452,495	0.94:1
TOTAL FISH AND WILDLIFE	<u>\$48,388,000</u>	<u>\$ 5,922,195</u>	<u>\$11,885,815</u>	<u>2.01:1</u>
TOTAL AUTHORIZATION REQUEST 2/	\$45,788,000	\$ 5,638,938	\$11,629,703	2.06:1

1/ These economic analyses are not normal project benefit-cost studies. The compensation actions recommended herein are required to replace project-caused losses and return the resource to a level which existed prior to project construction and therefore are not benefits to the total project. The benefit-cost ratios discussed here only evaluate the efficiency of moneys recommended for these compensation actions in relation to the value of the resource which is to be replaced.

2/ This report seeks authority for the off-project portion of the plan.

TABLE 16

SUMMARY OF FACILITIES AND COSTS OF WILDLIFE COMPENSATION FACILITIES

LOWER SNAKE RIVER PROJECT

<u>Facility</u>	<u>Land Requirements</u>	<u>Initial Cost^{1/}</u>	<u>Cost Annual O&M</u>
<u>Fish</u>			
Fall Chinook Hatchery	40 Acres	\$ 6,200,000	\$ 450,000
Spring and Summer Chinook Hatchery	80 Acres	11,500,000	900,000
Steelhead Trout Hatchery	80 Acres	20,500,000	1,500,000
Rainbow Trout Hatchery	10 Acres	3,000,000	100,000
Fisherman Access Lands & Development	750 Acres	1,050,000	
<u>Wildlife</u>	<u>Total</u>	<u>\$42,250,000</u>	<u>\$2,950,000</u>
Acquisition and Development of Off-Project Lands	23,400 Acres ^{2/}	\$ 2,379,000	\$ 1,000
Game Bird Replacement		<u>1,159,000</u>	<u>\$ 1,000</u>
<u>TOTAL COST</u>		<u>\$45,788,000</u>	<u>\$2,951,000</u>

^{1/} Includes initial development of lands.

^{2/} Includes 23,000 acres in easement and 400 acres in fee.

STATEMENT OF FINDINGS

SPECIAL REPORT

LOWER SNAKE RIVER FISH AND WILDLIFE COMPENSATION PLAN LOWER SNAKE RIVER, WASHINGTON AND IDAHO

1. PROJECT DESCRIPTION:

The Lower Snake River Project consists of four dams: Ice Harbor, Lower Monumental, Little Goose, and Lower Granite. These dams were authorized in Public Law 14, 79th Congress, 1st Session, approved 2 March 1945, to provide hydroelectric power, irrigation, and slackwater navigation from the Columbia River to the Lewiston, Idaho-Clarkston, Washington, area.

Initial plans for each dam provided for three power-generating units, a navigation lock, and fish passage facilities for upstream migrating salmonid fish. Space was also provided in the powerhouse for three additional power units to be added at a later date. Provisions were later made for bypass systems to allow downstream migrating juvenile salmonids to escape from the gatewells and permit deflection of fish from the penstocks. The three additional generating units are now being completed at Ice Harbor Dam and are scheduled for installation and completion at the other three dams by 1979.

2. PURPOSE OF THE REPORT:

Provisions for compensation of fish and wildlife losses caused by construction of the Project were not included in the original Project authorization. It has become increasingly obvious since completion of Ice Harbor Dam in 1962 that losses to these resources have occurred, and are continuing to occur, and have increased with the completion of each succeeding dam. It is the purpose of the report to evaluate those

losses and to recommend the most feasible means for providing compensation. The data contained in the report are based on information provided by the U.S. Fish and Wildlife Service; National Marine Fisheries Service; the fish and wildlife agencies of the States of Washington, Oregon, and Idaho; independent analyses of the agencies' data by two independent consultants retained by the Walla Walla District; and four public meetings. The Fish and Wildlife Coordination Act, PL 85-624, 85th Congress, enacted 12 August 1958, is the basic authority under which the report is submitted.

3. RECOMMENDED COMPENSATION MEASURES:

In order to compensate for fish and wildlife losses caused by construction of the Lower Snake River Project, it is recommended that:

a. Hatchery and associated facilities be constructed to maintain returning adult runs of 18,300 fall Chinook salmon, 58,700 spring and summer Chinook salmon, and 55,100 steelhead trout.

b. Provisions be made for replacement of 67,500 angler-days of lost resident fishery use.

c. Lands be acquired off Project in fee or easement for hunter and fisherman access for project-caused losses to chukar partridges, and for stocking of pheasants to compensate for lost hunter-day use.

d. Provisions be made for production of pheasants to stock Project and acquired lands to replace wildlife losses.

4. FINDINGS:

In view of the extensive and continuing losses to the anadromous fish runs of the Snake River drainage, to wildlife habitat and population

numbers, it appears that the recommended measures contained in the Special Report, Lower Snake River Fish and Wildlife Compensation Plan, Lower Snake River, Washington and Idaho, are the most practical and reasonable means at present of compensating for losses to those resources caused by construction of the Project.

Since completion of the Project was deemed to be in the best interest of the total public, I find that compensation for losses to the fish and wildlife resources of the area is a necessary part of the Project responsibility.

CONCLUSION

From the data presented in this report and supported by the reports of the State and Federal fish and wildlife agencies, attached as Appendixes A and B, and by reports furnished by independent consultants attached as Appendixes C and D, it has been concluded that serious losses have occurred to the fish and wildlife resources of the area through construction of the four lower Snake River dams. It is further concluded that these losses can be compensated for by implementation of the plan as outlined in this report. A summary of the recommended features with associated costs is shown in Table 16 and described in the following paragraphs:

1. Compensation of Fishery Losses:

a. Hatchery and associated trapping and holding facilities to rear the progeny of 2,290 adult female fall Chinook salmon, produce 101,800 pounds of smolts, and to be capable of returning 18,300 adults to the project area. These facilities would require approximately 4¹/₂ acres of land to be acquired in fee. The estimated initial construction cost is \$6,200,000 with annual operation and maintenance costs of \$450,000.

b. Hatchery and associated trapping and holding facilities to rear the progeny of 2,145 adult female spring and summer Chinook salmon, produce 450,000 pounds of smolts, and to be capable of returning 58,700 adults above the project. These facilities would require approximately 80 acres of land to be acquired in fee and have an estimated initial construction cost of \$11,500,000 and annual operation and maintenance costs of \$900,000.

c. Hatchery and associated trapping and holding facilities to rear the progeny of 3,390 adult female steelhead trout, produce 1,377,500 pounds of smolts, and to be capable of returning 55,100 adults above the

project. These facilities would require approximately 80 acres of land to be acquired in fee. Estimated initial construction costs are \$20,500,000 with annual operation and maintenance costs of \$1,500,000.

d. Design and construction of these hatcheries would be funded through future appropriations to the Corps of Engineers. Operation and maintenance would be funded through future appropriations to the U.S. Fish and Wildlife Service or National Marine Fisheries Service. Prior to the actual design of the facilities, the level of hatchery compensation will be reviewed and possibly adjusted depending on the success of bypass, truck and haul, Dworshak hatchery returns, and any adverse effects of expanded powerhouses and increased peaking operations.

e. Hatchery facilities capable of producing 93,000 pounds of trout annually for stocking local streams to replace the lost sport-fishing opportunity or other alternatives of equal or lesser cost. The estimated construction cost of these hatchery facilities is \$3 million, and annual operation and maintenance cost is \$100,000. These facilities would require approximately 10 acres of land to be acquired in fee. The determination of the actual method of replacing the lost fishing opportunity will be determined by the Corps of Engineers in cooperation with the Washington Department of Game. Construction of the hatchery or other alternate measures will be funded through future appropriations to the Corps of Engineers. Operation and maintenance of the constructed facilities would be funded through future appropriations to the U.S. Fish and Wildlife Service.

f. The Corps of Engineers would, if appropriate, transfer title of the above hatchery and fish cultural facilities to the appropriate Federal or State fishery agency in a manner consistent with desires of the Administration and Congress under authority of the Fish and Wildlife Act of 1956 (16 USC 742) or by mutual agreement with the appropriate agency.

g. Acquisition of 750 acres of land along the Snake River and tributaries of streams adjacent to the lower or middle Snake River in easement or fee to partially replace loss of stream-type steelhead

and salmon sport fishery in the 150 river miles of the project area. Acquisition and development would be accomplished under an agreement between the Corps of Engineers and the States of Washington and Idaho with ownership vested in the States. The States would acquire the land on a willing-seller concept and accomplish the initial development with costs to be reimbursed by the Corps of Engineers. Based on the percent of project lands affected in each State, the acquisition would be allocated as 700 acres to the State of Washington and 50 acres to the State of Idaho. Assuming funding is available, acquisition of these lands would be accomplished within a period of 10 years following initial appropriation of funds, or the authorization in total or part would be canceled. Estimated cost of acquisition is \$750,000 with initial development cost of \$300,000. Funding of land acquisition and development would be by future appropriation to the Corps of Engineers. Future development, if any, and operation and maintenance of these lands would be the responsibility of the State in which they are located.

2. Compensation of Wildlife Losses:

a. Acquisition of approximately 400 acres of riparian habitat in fee and 8,000 acres of farmland in easement surrounding these riparian lands to provide partial compensation for project-caused pheasant and quail hunting losses and additional hunting opportunity as a substitute compensation for nongame species. Acquisition of the land would be by agreement between Corps of Engineers and the Washington State Department of Game whereby the Game Department would undertake the actual acquisition on a willing-seller concept within a 10-year period after initial appropriation of funds. Under this agreement, title to the fee lands would be vested with the State for such period of time that the land is used for fish and wildlife management purposes. At the end of such time title to any portion not being used for this purpose would be conveyed to the United States Government without additional compensation. The Corps will require that selection of hunter easements and wildlife habitat "core" areas be accomplished in a manner to provide viable wildlife management units, that all involved landowners in a given management unit are in agreement (willing sellers), that each management unit plan be concurred in by the involved County Planning Commission, and that the payment considerations be fair and reasonable. Costs for acquisition and initial

development of these lands by the State would be reimbursed by the Corps of Engineers. Ownership of estates in the lands would be vested in the State. The initial cost of these lands is estimated at \$2,100,000 for acquisition, administrative overhead, and initial development. Annual operation and maintenance costs would be a State responsibility.

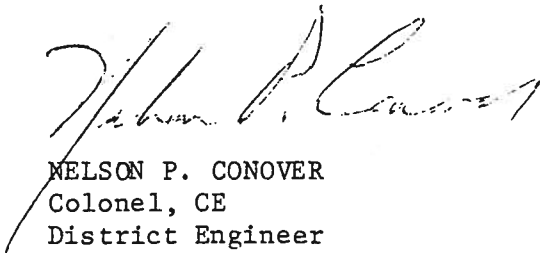
b. Acquisition of approximately 15,000 acres of land in easement to provide hunter access as partial compensation for project-caused losses to chukar-partridges. Acquire approximately 50 small select parcels of land (0.1 acre each) in easement or fee and construct bird-watering devices on these lands. The land would be located in the draws along the sides of the Snake River Canyon adjacent to the project area and would provide access to project lands from surrounding private lands. Access to these lands would be acquired by the Corps of Engineers on a willing-seller concept and would be managed by the Corps of Engineers in conjunction with adjacent project lands. Land access acquired by easement would be limited to the hunting seasons and would not be fenced so that normal rangeland activities could be continued by the owners. Lands around the bird-watering devices would be fenced. Acquisition of these lands and construction of watering devices are estimated to cost \$279,000 and the annual operation and maintenance cost \$1,000. Assuming funding is available, acquisition of these lands would be accomplished within a period of 10 years following initial appropriation of funds.

c. The Corps of Engineers would enter into an agreement with the Washington Department of Game to provide game birds to stock project and acquired off-project lands for compensation of lost hunter-day use and animals caused by the project construction. The necessary stocking effort to fulfill compensation is estimated to be 20,000 birds per year for a 20-year period by which time habitat and a natural brood stock should be established. The agreement would provide for a lump-sum payment of \$1,159,000, estimated capitalized value of the 20-year stocking period, to the Washington Department of Game to provide the birds either by outright purchase, remodeling an existing bird farm, or constructing a new facility.

3. Estimated total first cost to the United States for implementation of the foregoing fish and wildlife compensation plan is approximately \$45,788,000. The total Federal cost for annual operation, maintenance, and replacement is estimated at approximately \$2,951,000. Federal funding for acquisition and initial development of habitat and fisherman and hunter access lands by the State would be subject to their agreement to fund any additional development and annual operation and maintenance costs.

RECOMMENDATIONS

I recommend that additional measures be authorized for development to compensate for fish and wildlife losses incurred at existing projects on the lower Snake River generally as described in this special report, with such modifications as, at the discretion of the Chief of Engineers, may be advisable, at an estimated first cost to the United States of \$45,788,000 for construction and \$2,951,000 annually for operation and maintenance and replacement.



NELSON P. CONOVER
Colonel, CE
District Engineer


NPDPL-ER (30 May 75) 1st Ind

SUBJECT: Special Report - Lower Snake River Fish and Wildlife Compensation
Plan, Lower Snake River, Washington and Idaho

DA, North Pacific Division, Corps of Engineers, 210 Custom House, Portland,
Oregon 97209 25 June 1975

TO: Chief of Engineers

I concur in the conclusions and recommendations of the District Engineer.

A handwritten signature in dark ink, appearing to read "Edwin S. Townsley", is written over the typed name.

EDWIN S. TOWNSLEY
Colonel, Corps of Engineers
Division Engineer

APPENDIXES

- A. A Special Report on the Lower Snake River Dams, Ice Harbor, Lower Monumental, Little Goose, Lower Granite, Washington and Idaho; National Marine Fisheries Service, Bureau of Sport Fisheries and Wildlife, September 1972.
- B. Appendix to Special Report on the Lower Snake River Dams, Ice Harbor, Lower Monumental, Little Goose, Lower Granite; Fish Commission of Oregon, March 1973.
- C. Special Report to the U.S. Army Corps of Engineers on Two Reports Concerning Proposed Compensation for Losses of Fish Caused by Ice Harbor, Lower Monumental, Little Goose, and Lower Granite Locks and Dams Projects, Washington and Idaho; Ernest O. Salo, 26 June 1974.
- D. Report on the Lower Snake Wildlife Mitigation Proposals; W. L. Pengelly, et al., 1 June 1974.